the OIL AND GAS JOURNAL

JUNE 1, 1959

Well costs continue to skyrocket ▸ 89

West Coast firms push regular ▸ 92

Sidon: Oil port for Middle East ▸ 110
(Seventh in a series)

Systems engineering in pipelining ▸ 154

Tempo quickens on Lake Erie ▸ 222

Next Week:
REPORT ON THE
5th WORLD PETROLEUM CONGRESS

Midyear
REFINING REPORT p. 117

Here's how you can

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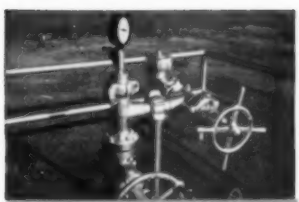
If specifying or buying valves is your job, let us give you the complete story on UNIBOLT Wing Valves.



Christmas tree flow manifold service

Heater/treater service

Centralized production manifold

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The OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
June 1, 1959

Drilling costs are still going up:

New industry-wide study just released shows that:

...Average per-well cost went up from $46,500 in 1955 to $50,200 in 1956.

...Cost per foot in producing wells was $12.94 in 1955 and $13.64 in 1956. Footage average for dry holes was $9.21 and $10.26.

Reasons for continued cost rise: More offshore activity, deeper holes, and higher prices for labor and materials used in drilling (For full details, see p. 89).

▼ ▼ ▼

Rotary rigs at work jumped to 2,197 last week, highest level of operations so far this year.

The gain of 81 rigs over the previous week also was the largest weekly increase so far this year.

Big increases were in Oklahoma, up 25 rigs; Texas, up 19; and Kansas, up 16.

Western Canada reported some recovery from the effects of spring thaws with a gain of 17 rigs to total of 141 working.

New drilling records will be set in the Rockies if the present rate of new locations continues.

New locations were the heaviest of the year last week. Operators announced 166 new spots, 67 of them wildcats.

Regional leader is Wyoming with 17 wildcats and 17 field wells. Nebraska and New Mexico had 33 starts, 12 of them in Nebraska wildcats and 9 in New Mexico. Rotary rig count for region is up to 229.

The record so far this year is 329 more new starts announced than for the same period last year.

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Year's first exploration is announced for Washington.

Tideland Oil & Gas Corp., Seattle, will drill a wildcat on Long Island in Pacific County. Location is about 5 miles northwest of Johnson Landing.

A Calgary contractor, Canbridge Corp., Ltd., will drill the 6,000-ft. test. Equipment is being moved into location.

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First Cotton Valley oil discovery in Texas may change the exploration picture in East Texas.

Pan American has completed a three-zone strike at its 1 Giraud in Cass County 5 miles southeast of Linden. Tops of the three zones are 9,865, 10,254 and 10,620 ft.

Geologists call the discovery a hopeful sign in the hunt for Jurassic oil in Texas. Pan American's activities will be watched closely for indications of Cotton Valley potential in other parts of East Texas (Details in exploration section, starting on p. 221).

It's too early to write off Green County, Kentucky.

The area still is booming. Production has hit 40,000 bbl. daily. More than 300 rigs are running, completing the shallow wells in about a week's time.

Play has spread over five counties with new stepouts in Green, Metcalf, Taylor, and Adair counties within the past 30 days. Most of the rigs are trailer-mounted.

▼ ▼ ▼

Don't low-rate fire flooding.

Reputable engineers now contend much recent adverse publicity on economics of the process was based on misinformation or misrepresentation.

A case in point: It's a general feeling that key fire-flood to date—the multicompany project in South Belridge field of Kern County, California—was a physical success but an economic flop. Sources close to the operation say it was not an economic flop.

Confirming evidence is that nearly all of the 11 firms represented in the test now either are operating fire floods on their own or plan to launch one soon.

Engineers favoring fire floods say the oil-producing industry has a mental block on the process.

This stems from decades of dealing only with secondary-recovery operations requiring 20 to 40 years to complete.

Many engineers express horror at the high costs of fire floods, the extreme rate of corrosion, need for special metals, the sanding up problems.

Proponents say a fire flood can be started and completed (regulatory bodies permitting) in perhaps 2 years, about 10 to 20 times shorter than a water flood. Thus over-all corrosion and well-servicing costs for fire floods may be lower.

Big problem is reeducating the industry on savings to be realized in time.

▼ ▼ ▼

Petroleum additives take a big bite of research dollars.

U. S. industrial research on these chemicals runs to about $30 million annually, according to one consultant. Oil firms alone spend about 9% of their total research outlay on them.

Additives for petroleum products, however, have a bright

future. Their markets are expected to expand faster than those of the products to which they are closely tied (p. 96).

Heard at API refining sessions: Acetic anhydride provides a new route to upgrading petroleum distillates (p. 99). ...Ethyl scientists have come up with formulas which will give accurate octane ratings for gasoline blends (p. 99)...New electronic tools include a versatile measuring system and a computer which will control a distillation column at capacity vapor rate (p. 98)...Swap waste fuels for steam and power from electric firms, refiners advised. Benefits are savings in investment and operating costs.

▼ ▼ ▼

Oil jobbers have taken on a minor watchdog role in wake of mandatory imports controls.

Jobber associations have agreed to be alert to all price rises for crude or products and advise their Washington headquarters "for informational purposes only."

Jobbers sidestepped a plan to push tax collections for fear it would turn them into tax informers and snitches.

Both actions were part of jobber sessions held during API marketing gathering in Des Moines.

The octane race on the West Coast is centering now around regular grades of gasoline.

Marketers are hurriedly upgrading their regular to the 92-octane range to meet competition first set by Union Oil.

The new regulars fill the gap which existed between the new 100-octane premiums on the coast and old below-90 regular. The move may give refiners a breather in their premium-octane race (p. 92).

▼ ▼ ▼

Mergers and sales are in the news:

General American Oil offers $152 million for Arkansas Fuel Oil. But deal is opposed by Cities Service which holds 51% of Arkansas Fuel Oil stock. Cities Service is being forced by SEC to sell or buy up all the minority shares.

Continental Oil is buying control of San Jacinto Petroleum in a stock deal and is purchasing F. P. Kendall Oil Co., a top marketer in the southeast.

Ohio Oil also has acquired Aurora Gasoline Co., Detroit, in exchange for 875,000 shares of stock.

Independents plan court defense of Government's mandatory import-control program.

Hearing on test case has been set for June 22 in Houston federal court. Texas American Asphalt is bringing suit to prevent U. S. Customs from stopping shipment of Venezuelan crude to the company.

Texas American contends its quota is insufficient to supply its new refinery. It also claims the import program is illegal.

TIPRO and others plan either to intervene or file brief as friend of the court to support the import program.

▼ ▼ ▼

Notes on carbon black operations during 1958:

...Plants decreased from 42 to 41 but capacity of operating plants increased from 5,492,890 lb. daily to 5,631,900.

...Total production dropped from 1.79 billion pounds to 1.64 billion pounds, a decline of 8%.

...Value of carbon black at the plant dropped from 7.12 cents a pound to 7 cents. Drop in price and sales meant that product value declined $12.9 million to $115 million.

...Average price paid by carbon black plants for natural gas rose from 8.26 cents per M.c.f. to 8.44 cents. Price for liquid hydrocarbons dropped from 7.36 cents per gallon to 6.79.

▼ ▼ ▼

Labor front: Talk in steel circles is that strike is now appearing more likely. Little headway is being made in negotiations which resume again after a 6-day recess...Teamsters in Chicago have rejected 5-cent an hour wage hike offered by the gasoline retailers...All unions dealing with Shell have agreed to a joint bargaining program. None will agree to any change in pensions or employe savings plan without prior approval of all others...Merger is out for present between OCAW and the International Chemical Workers of America. Officials of two unions couldn't agree on joint organization.

▼ ▼ ▼

Texas oil industry may have bad tax news soon. It's a cinch to be tapped to help meet state's financial crisis.

Legislature, now in special session, is split whether to:

...Pick up the new revenues from same old sources, which are mainly the petroleum industry.

...Use a sales tax to distribute the load.

Prospects are that a solid front previously presented by the oil industry may be crumbling. This is due to governor's new proposal to cut current gas-production tax to 5% from 7% and levy a new 5% tax on gas reserves produced under contract. This new tax would principally hit gas-purchasing pipelines.

Natural-gas industry has finally tapped the attractive Florida market.

New 2,596-mile pipeline linking the Rio Grande valley with Miami this week starts flowing at a near capacity rate of 282,000 M.c.f. daily. Ceremonies in Florida Monday officially opened the $164-million project.

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TECHNOLOGY—OPERATION

Sulfide Scaling Under Hydrorefining Conditions 117
By W. H. Sharp and E. W. Haycock
Hydrogen sulfide partial pressure, temperature, and composition of steel are the main variables which affect corrosion rate. Graphical summaries of predicted long-term corrosion agree well with reformer data but are conservative for mildly corrosive hydrodesulfurizer conditions.

Planning Power-Distribution Systems 121
By K. N. Thompson
Whether you are starting from scratch or are modernizing antiquated specifications to reduce costs yet improve reliability, considerable savings can be gained by proper planning.

Five Years of Processing Crude Oil at Low pH. 125
By J. A. Biehl and E. A. Schnake
Ohio Oil's Robinson refinery lowered pH on crude-oil overhead receiver waters and increased inhibitor injection into the vapor overhead some 5 years ago. These changes have resulted in excellent control of corrosion, cleaner equipment, and reduction of ammonia contamination in the hydrocarbon streams.

Optimum Use of Byproduct Hydrogen 129
By G. T. Gwin
The refiner engaged in full-scale platinum reforming of virgin naphtha has adequate hydrogen available for hydrotreating all fractions of the crude charge. This includes treating of all primary fractions except the light ends, and treating of naphtha and heating-oil products from cat cracking, as well as treating of lubricants, aliphatic solvents, and paraffin wax.

Guiding Refining Operations With Pilot Plants 135
By W. M. Miller
Pilot-plant data provide a valuable source of useful and reliable information for planning and controlling refinery operations at the Avon and Delaware refineries of Tidewater Oil Co.

Systems Engineering for Centralized Control in Pipelining 154
By Max T. Nigh
Systems engineering involves the application of automation to a number of different fields. The results is the development of complex data-handling systems which are readily adaptable to centralized control.

Thirty Years of Sand-Control Experience 162
By P. E. DesJardins
An analysis of 118 sand-control jobs in 32 wells producing from 55 zones over a period of 30 years yields valuable information on sand-control techniques.

Refinery Cost Indexes 171
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Jet-Bit Deflection Saves Money in Directional Wells 172
By Roy P. Dwyer
The new method saves time in drilling surface holes, steps up directional drilling rate, and avoids use of costly extra equipment.

Getting the Most Out of BOP Ram Packers . . 176
By M. C. Lucky
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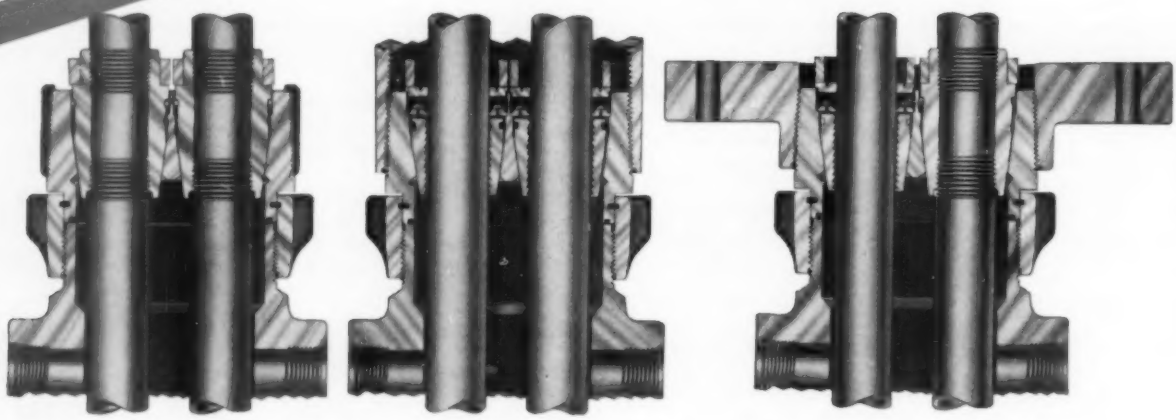

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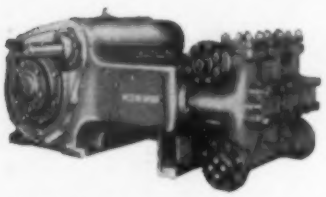

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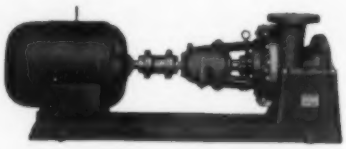
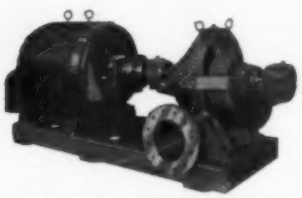


ES CENTRIFUGAL PROCESS PUMPS . . . Single or two-stage heavy-duty type for elevated temperature applications to 900°F., employing vertically split case and single stuffing box for conventional packing or mechanical seal of your choice. End suction, as illustrated, is standard construction—can also be furnished with top suction when preferred. Twenty sizes provide capacities from 15 to 2,000 GPM, 50 to 1100-ft. head, 2 to 250 HP.



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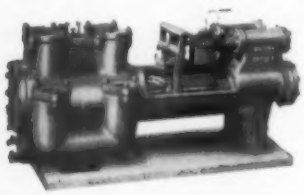

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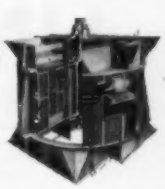
For more complete details on what the Ljungstrom Air Preheater can do for you—for an analysis of the heat recovery benefits attainable in fuel-burning equipment—call or write The Air Preheater Corporation.

Wherever You Burn Fuel, You Need Ljungstrom

The Ljungstrom operates on the continuous regenerative counterflow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves, the heat is transferred from the waste gases to the incoming cold air.



The Air Preheater Corporation 60 East 42nd Street, New York 17, N. Y.

FR®

—standard on LINK-BELT oil field roller chain

FATIGUE RESISTANT

U. S. Patent No. 2,517,497

Fatigue Resistant processing of sidebars develops greater dynamic strength for hard-working oil field drives . . . increases endurance limit

No ordinary roller chain can long withstand the brute punishment of drilling service. That's why Link-Belt adds the FR process—a proven way to promote longer chain life. By compressing the metal around pitch holes, Link-Belt greatly strengthens the critical sidebar areas most vulnerable to fatigue . . . thus creating extraordinary *dynamic strength.*

And FR is just one of many Link-Belt "extras":

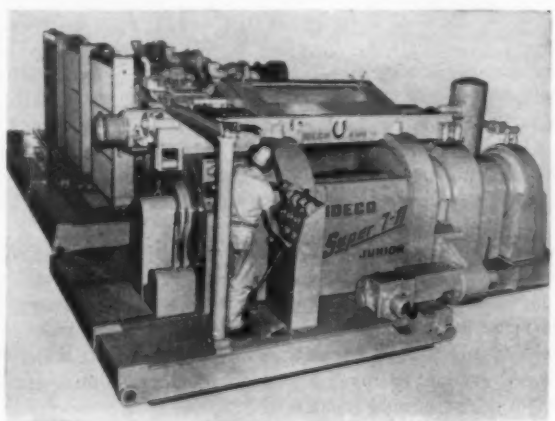
- SHOT-PEENED ROLLERS
- SHEPHERD'S CROOK COTTERS
- PRE-STRESSING
- CLOSER HEAT-TREAT CONTROL
- E-Z ASSEMBLY
- DOUBLE BOXING

Any leading supply store in the field can give you full details and a copy of Link-Belt Catalog 2880.

LINK-BELT

ROLLER CHAINS & SPROCKETS

LINK-BELT COMPANY: Indianapolis 6, Houston 1, Dallas 21, Odessa, Tex., Shreveport, La., Los Angeles 33, Scarboro (Toronto 13); Export Office, New York 7. Distributors in All Fields. 10,141



NEW IDECO JUNIOR SUPER 7-11 is equipped with Link-Belt multiple-width precision steel roller chain with "FR". *Since this feature involves no alterations in dimensions of chain parts, Link-Belt roller chain is interchangeable with standard chains and sprockets.*

PROGRESS, TOO, HAS ITS GOLDEN RULE...

It's the *teamwork* of men capable of producing progress—refiners and Cyanamid chemists.

This teamwork has produced concrete benefits. It helped bring the development of one of the first synthetic fluid cracking catalysts. It helped produce the first fully regenerative platinum reforming catalyst. It can help you meet the almost-relentless demands for ever superior fuels.

Behind Cyanamid's service as a major catalyst producer are its unlimited resources as a major chemical producer. Cyanamid's man with the golden rule can place at your disposal vast research and development facilities.

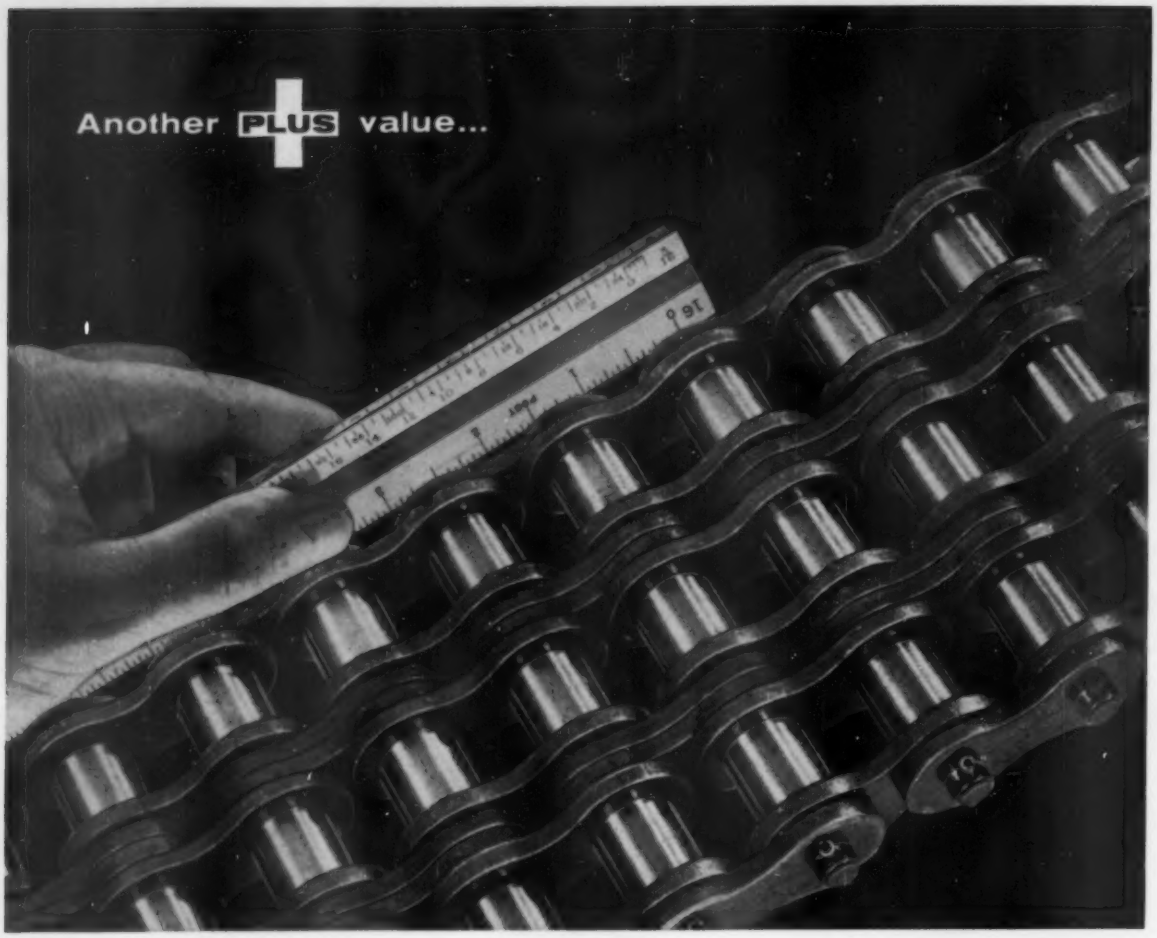
Basic in Catalyst Chemistry

SEE YOU AT THE CONGRESS SHOW

Cyanamid will participate at the Fifth World Petroleum Congress Exposition at the New York Coliseum, May 29 through June 5. Be sure and see the Cyanamid Refinery Chemicals Display.

CYANAMID

AMERICAN CYANAMID COMPANY
REFINERY CHEMICALS DEPARTMENT
30 Rockefeller Plaza, New York 20, N. Y.



PITCH CONTROL FOR HIGHEST FATIGUE STRENGTH

Accurate control of chain pitch is a *must* to meet the demands of today's drilling service. Variations in pitch cause uneven loading on the chain parts with resultant early fatigue failures.

In Rex Oil Field Roller Chains you get highest fatigue strength because pitch is *accurately* controlled...each link in the strand has controlled pitch as well as the entire strand. Link plates, bushings, rollers and pins are all designed and manufactured to extremely accurate tolerances to assure pitch control *throughout the long life of the drive.*

For longest life...highest fatigue strength, get the chains that give you ALL the *plus* values: Rex Roller Chains. Available in GLIDE-FIT (cottered) or DRIVE-FIT (riveted) styles. CHAIN Belt Company, 4619 W. Greenfield Ave., Milwaukee 1, Wis.

Get ALL the Plus Values

- Pitch control
- Guide-pierced and ball-swaged link plates
- Built-in beneficial stresses
- Positioned seam bushings
- Oil holes for effective lubrication
- Gap-free round rollers
- Roll pin fasteners...proved best

For Highest Fatigue Strength ...Longest Wear Life

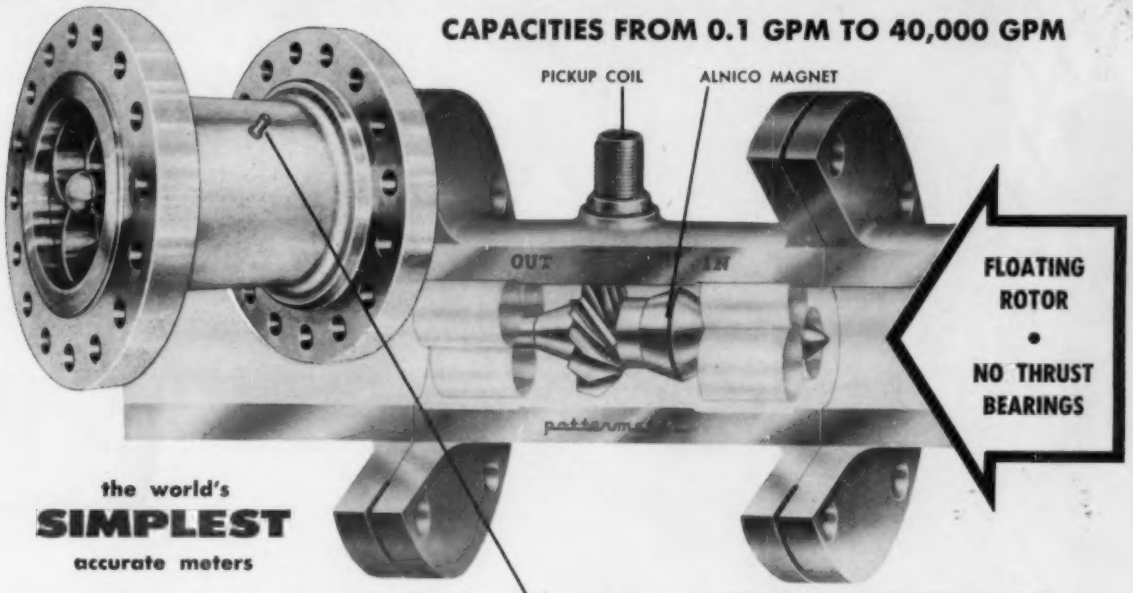
REX® OIL FIELD ROLLER CHAINS

Oil Field Offices: Dallas • Houston • Los Angeles • Odessa • Oklahoma City • New York. Export Offices: Milwaukee • New York

pottermeter BOWSER

INLINE ELECTRONIC TURBINE TYPE METERS

CAPACITIES FROM 0.1 GPM TO 40,000 GPM

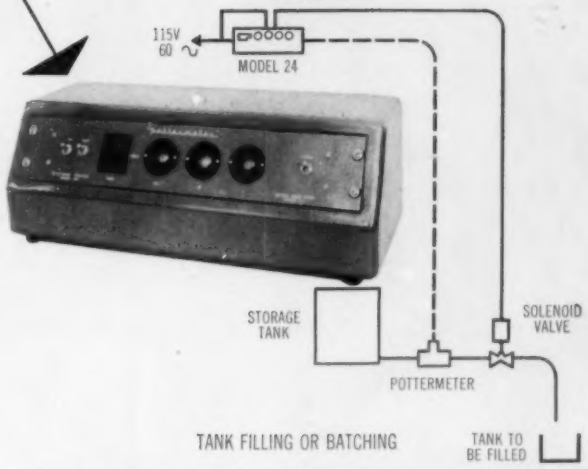


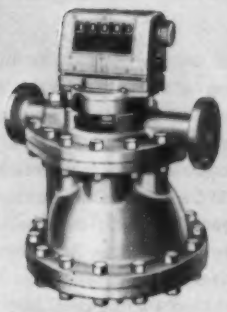
the world's SIMPLEST accurate meters

An Alnico magnet in the turbine rotor generates electric current directly proportional to the flow rate in the pipe. This activates readout or control equipment located at or remote from the Pottermeter unit.

PROVIDES BASIC INSTRUMENTATION FOR ANY AUTOMATION SYSTEM

Operating by gravity or pump pressure, Pottermeters are available in all pipe sizes. Electronic totalizers, recorders or controllers meet any need for automated liquid process or transfer operations. Potter-Bowser sales engineers in principal cities confer promptly with systems or plant engineers to detail availabilities and application data.



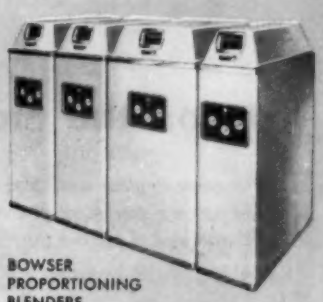


BOWSER XACTO METERS

BOWSER XACTO METERS AND PROPORTIONERS
positive-displacement piston type

Wherever mechanically driven readout and control equipment is indicated, and where positive-displacement metering is needed or costs less, Bowser Xacto Meters (leading all others in industry) are unexcelled for dependability and accuracy. Capacities: 6 GPH to 250 GPM

Xacto Meter equipped proportioners are used to blend two or more liquids in continuous flow at accuracies to ¼ of 1 percent. First in lube oil blending, Bowser proportioners also handle most other liquids used by process industries.



BOWSER PROPORTIONING BLENDERS

Write For Catalog

Potter-Bowser Division* BOWSER, INC. *Fort Wayne, Indiana

Up on the monkey-board

IT'S nerve-tingling work standing on a monkey-board, 100 feet up on a derrick, grappling with a 90-foot length of 4½-inch drill pipe. A job like this calls for a qualified derrickman!

Doesn't the same hold true with tubular materials? Doesn't the job of searching far beneath the earth's surface call for *qualified* materials that can stand up under severe twisting action, fatigue and collapse—materials that are designed to drill deep today . . . deeper tomorrow?

That's why USS National Seamless Oil Country Tubular Products are acknowledged the world over as the most ideal materials for deep-well work. They *have* the strength and dependability to do any oil country job. Their outstanding strength can be attributed to not one, but two vital factors—quality steel and a quality control method of manufacture. Each seamless tube is pierced from a solid billet

of steel. And only steel of the very best forging properties and of the highest uniformity can be used, since the modern piercing operation tends to seek out any defects in the metal.

For drill pipe, casing and tubing that can really *take it*—products that will consistently give you the most service *per dollar invested*—remember to specify USS National Seamless Oil Country Tubular Products . . . every time.

For further information, write to National Tube Division, United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa. Export distributors: United States Steel Export Company, New York.

USS and National are registered trademarks

National Tube Division of USS **United States Steel**

HOW TO MAKE EXTRA PROFIT WHEN USING BARITE RECOVERY MACHINES

You will be money ahead if you answer these important questions before using any barite recovery machine

How Is Barite Lost?

Most Barite is lost when the tanks are jetted to remove excess solids in the form of fine drilled clays. *If this jetting were not necessary, there would be little need for a barite recovery machine.* When you jet your tanks to get rid of unwanted clays, you also jet out large quantities of valuable barite. The problem is to *selectively* discard unwanted clays and retain costly barites, while processing a minimum volume of mud.

So What Should A Machine Do?

The first and most important requirement is *to reject drilled clays.* Next in importance is the barite recovery efficiency. Virtually no chemicals used in drilling muds can be separated from drilled clays with practical equipment. For that reason, the higher the clay rejection efficiency, the less mud need be processed. As a result, *chemical and barite losses are held to a minimum.*

High clay rejection efficiency is an important reason why the *Clayjector®* is preferred by so many operators. As a matter of fact, it was named Clayjector to dramatize the importance of clay rejection.

What Are Some Other Requirements?

During mud maintenance, the high clay rejection and barite recovery efficiencies shown in the table below are of great importance. Together they result in less barite lost for each pound of clay removed.

Where reserve pits contain important quantities of barite, the Clayjector is outstanding. It has a much higher capacity than other type machines and it delivers *almost completely pure barite. This is an important advantage when very heavy muds are used,* since the clay content of these muds must be closely controlled.

Because of unusually low rental costs, the Clayjector has been proved profitable when as few as 60 sacks of barite per day are required for mud maintenance.

The Clayjector is simple and easy to operate. It is easy to move and it is flexible in operation. All barite is returned as a smooth slurry that is easy to mix. The unit results in faster drilling and greater safety from lost circulation or blowouts because closer control of mud is possible.

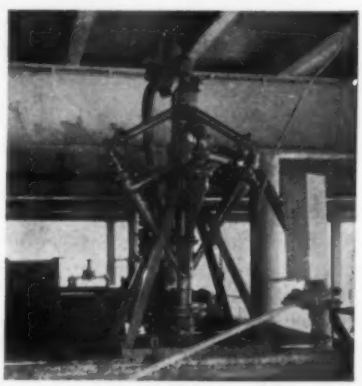
Get the whole story from your SWACO representative or write us direct. If you have been using other barite recovery machines, you will be surprised at the added savings you can make. If you are not using a barite machine, and are using weighted mud of over 11.5 pounds per gallon, you probably can save money by installing a Clayjector.

®Clayjector is trademark of Dorr Oliver, Inc., Stamford, Conn.

FIELD PERFORMANCE DATA ON CLAYJECTORS

	Stream	Weight #/gal	Flow gpm	Bar. Rec. %	% Clay Rejec.
Offshore, La. 15.1 #/gal mud 1 Clone S.G. Bar = 4.18 10/22/58	u.f. o.f.	17.3 8.9	3.3 21.4	95.1	71.1
Offshore, La. 14.8 #/gal mud 2 Clones S.G. Bar = 4.17 11/1/58	u.f. o.f.	17.1 8.9	6.8 40.0	89.7	73.0
Offshore, La. 13.6 #/gal mud 1 Clone S.G. Bar = 4.19 about 11/25/57	u.f. o.f.	16.0 8.8	3.8 21.4	93.8	73.7

U.F. = Underflow — Barite slurry returned to mud system.
O.F. = Overflow — Light solids and fluids to waste.
These results were calculated by an independent testing laboratory from samples taken at the rig.



SWACO

SALT WATER CONTROL Inc.

1809 Continental National Bank Bldg. Phone: ED 2-4434 Ft. Worth 2, Texas

In Petroleum and Petrochemical Engineering

PARSONS

means "Specialized Versatility"

Repeat business has played a vital role in establishing Parsons as a leader in the engineering-construction field. Satisfaction with Parsons' performance, on all kinds of petroleum and chemical facilities, has brought repeat assignments on job after job—time after time. When you think of engineering or construction, think of Parsons, and you too will realize that

PARSONS MEANS "SPECIALIZED VERSATILITY"

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ELECTRONICS

WATER DEVELOPMENT AND SYSTEMS

EVALUATION AND ECONOMICS

Refinery licks tough heat exchanger crisis with emergency tube service

A sudden tube failure at the Pure Oil Company's Refinery in Lemont, Illinois, recently put Bridgeport's condenser tube service to the test. The failure hit on Friday afternoon—just before business slowed down for the week end. Faced with the prospect of costly equipment down time, the refinery called Bridgeport's Chicago office to find out how fast new tubes could be supplied. Here's a round-the-clock story of how the emergency was licked.

Friday, 2:30 P.M.: Salesman from Bridgeport's Chicago office learns that Pure Oil needs 900 Admiralty condenser tubes, and fast.

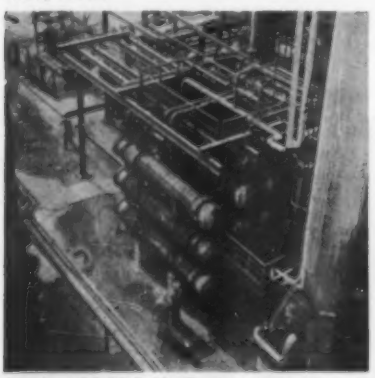
Friday, 3:00 P.M.: Salesman contacts our Bridgeport, Connecticut, mill and is informed that order can be delivered to Pure Oil Refinery in one week.

Friday, 3:30 P.M.: Sudden change in customer's needs makes immediate delivery of tubes imperative.

Friday, 4:15 P.M.: Chicago office checks through coast to coast network of Bridgeport warehouse stocks. Locates tubes at Beaumont, Texas.

Friday, 4:30 P.M.: Special night shift at Beaumont is put on job to cut tubes to special lengths and pack for shipment.

Saturday, 4:00 A.M.: Special truck leaves Beaumont, Texas, with order for Pure Oil Refinery in Lemont, Illinois.



Sunday, 11:30 P.M.: Truck arrives at Lemont Refinery with 900 Admiralty tubes, ready for repair work to start Monday morning.

While emergencies like this don't happen every day, they do prove dramatically that Bridgeport's customer service can come to the rescue. When we talk about fast service from our network of sales offices and warehouses, we mean it. Let us tell you more about our service on your condenser and heat exchanger tube needs, whether they're emergencies or normal deliveries. Call your nearest Bridgeport Sales Office, or get in touch with us direct.

Write for your free copy of Bridgeport's Condenser and Heat Exchanger Tube Handbook. Address Dept. 5703.

BRIDGEPORT BRASS COMPANY

Bridgeport 2, Connecticut • Sales Offices in Principal Cities

Specialists in Metals from **A***luminum to* **Z***irconium*

YOU GET "PRODUCTION-PROTECTION"...

when you use

HALLIBURTON CEMENTING TOOLS

Halliburton engineered and "well-qualified" tools... in field after field... well after well... contribute to the better cementing necessary to help provide future *production-protection* for your wells.

HALLIBURTON SELF-FILL DIFFERENTIAL COLLAR ...engineered to fill casing automatically. Used specifically with Halliburton Super Seal Floating equipment for greater speed and safety as it is run into your well.

* *Only one Fill-up collar is required for each casing string!*

Self Fill Differential Collar offers these important advantages:

- Reduced running-in time
- Minimizes plugging, even when drilling mud contains high percentage of foreign matter
- Effective even in the deepest wells
- Circulation is established downhole without tripping valve
- Flushes float valve of cuttings and settlings—reducing low pressure area below shoe

* **Here's a real advantage!**

No other differential fill-up equipment on the market continues to operate after circulation is once established... While running casing, circulation can be established at intervals, and the Halliburton Self-Fill Differential Collar will continue to function until it is sheared by bottom plug or by dropping a ball.

Super Seal Float Collar

HALLIBURTON SUPER SEAL FLOAT COLLAR... Used in conjunction with the Self-Fill Differential Collar, helps prevent blowouts by eliminating low pressure areas. These companion-tools will not restrict the downward flow of fluids when casing is raised. Float Valve assembly is held in place with special shock resistant concrete with high shear and compressive strength. Under normal drilling conditions, no "drilling-out" difficulty is present.

Turbo-Jet Float Shoe

HALLIBURTON TURBO-JET FLOAT SHOE... for Maximum Dependability. Agitates and distributes cement by powerful self activating built-in rotor which forces a jet-stream of fluid through side ports and bottom—minimizing channeling and giving more uniform cementing around casing.

Turbulent action "jets" off and washes mud cake from bottom and sides of hole, prior to cementing, substantially reduces contamination. Equipped with back pressure valve which helps assure maximum dependability even in deep-hot holes. All parts are drillable.

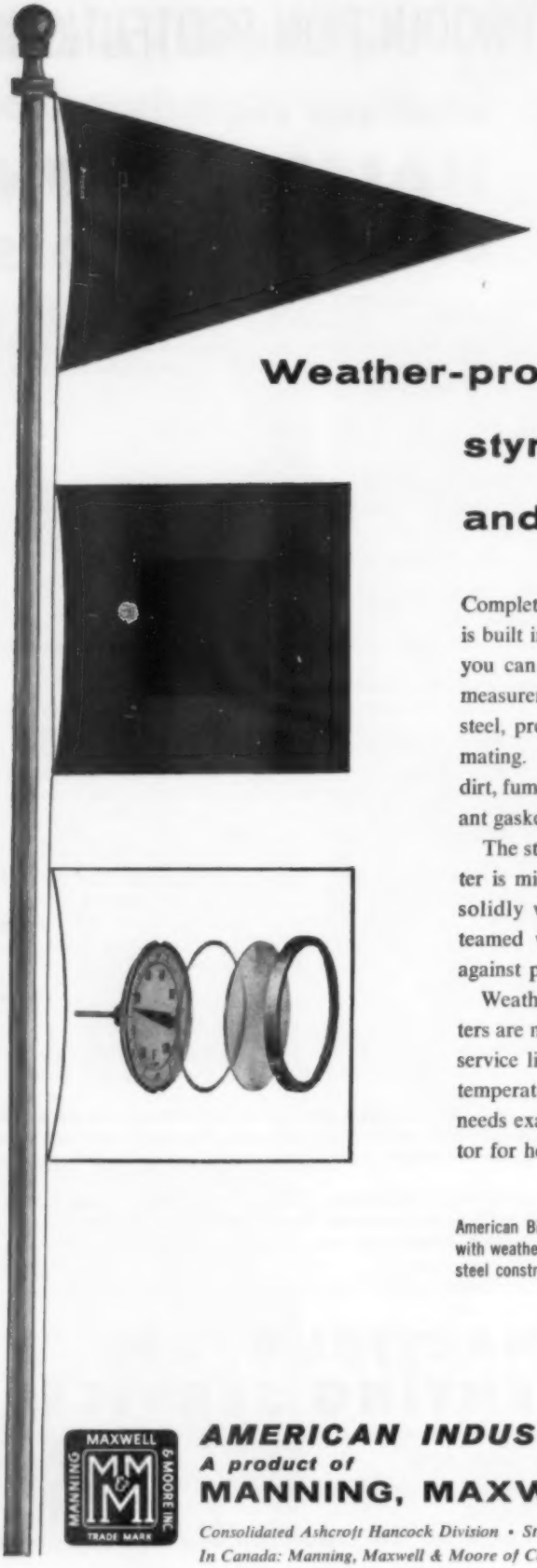
Put the advantages of these Halliburton *"production-protection"* tools to work in your well... and for additional information about other Halliburton field-proven products that help successfully cement your well... call your Halliburton Representative.

"284 Service Centers—Just Minutes Away From Your Wells"

HALLIBURTON CEMENTING SERVICES

HALLIBURTON OIL WELL CEMENTING COMPANY • DUNCAN, OKLAHOMA

"CONTINUE TO LOOK TO HALLIBURTON — FOR LEADERSHIP"



Weather-proof construction stymies erosion and corrosion

Complete protection against erosion and corrosion is built into American Bi-Metal Thermometers, so you can always be sure of accurate temperature measurement. Both case and bezel are stainless steel, precisely fitted and gasketed to insure snug mating. Whatever the weather, rain, sand, dust, dirt, fumes and frost are sealed out by a heat-resistant gasket between case and thick cover glass.

The stem of the American Bi-Metal Thermometer is mirror-smooth stainless steel. All joints are solidly welded. Top resistance to corrosion is teamed with strength, rigidity and tight closure against process pressures.

Weather-proof American Bi-Metal Thermometers are noted for high sustained accuracy and long service life. There are mounting styles, dial sizes, temperature ranges and stem lengths to meet your needs exactly. Ask your industrial supply distributor for help in proper selection.

American Bi-Metal Thermometer with weather-proof stainless steel construction.

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AMERICAN INDUSTRIAL THERMOMETERS

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1947 1952 1956

Diamond Drilling

EVOLUTION

Spearheaded by D&S–TRUCO

During the past 10 years many new principles have evolved to change the design and performance of diamond drilling and coring bits. Through this era the industry has looked to D&S for leadership.

With the introduction of the now famous TRI-DIA bits, D&S scored a major industry advance. Now, through research D&S brings you the all new TRI-Y jet action diamond drill bit . . . custom designed to give faster penetration, eliminate re-grinding center, last longer and give more overall rig savings.

WRITE OR CALL TODAY! Your D&S sales engineers will call on you and explain this revolutionary new Diamond Bit.

TRI-Y Standard recommended for extremely hard abrasive formations. Reduced Face TRI-Y recommended for sands, shales under pressure compaction.

DIAMOND DRILLING EQUIPMENT

6210 NORTH CENTRAL EXPRESSWAY | DALLAS, TEXAS

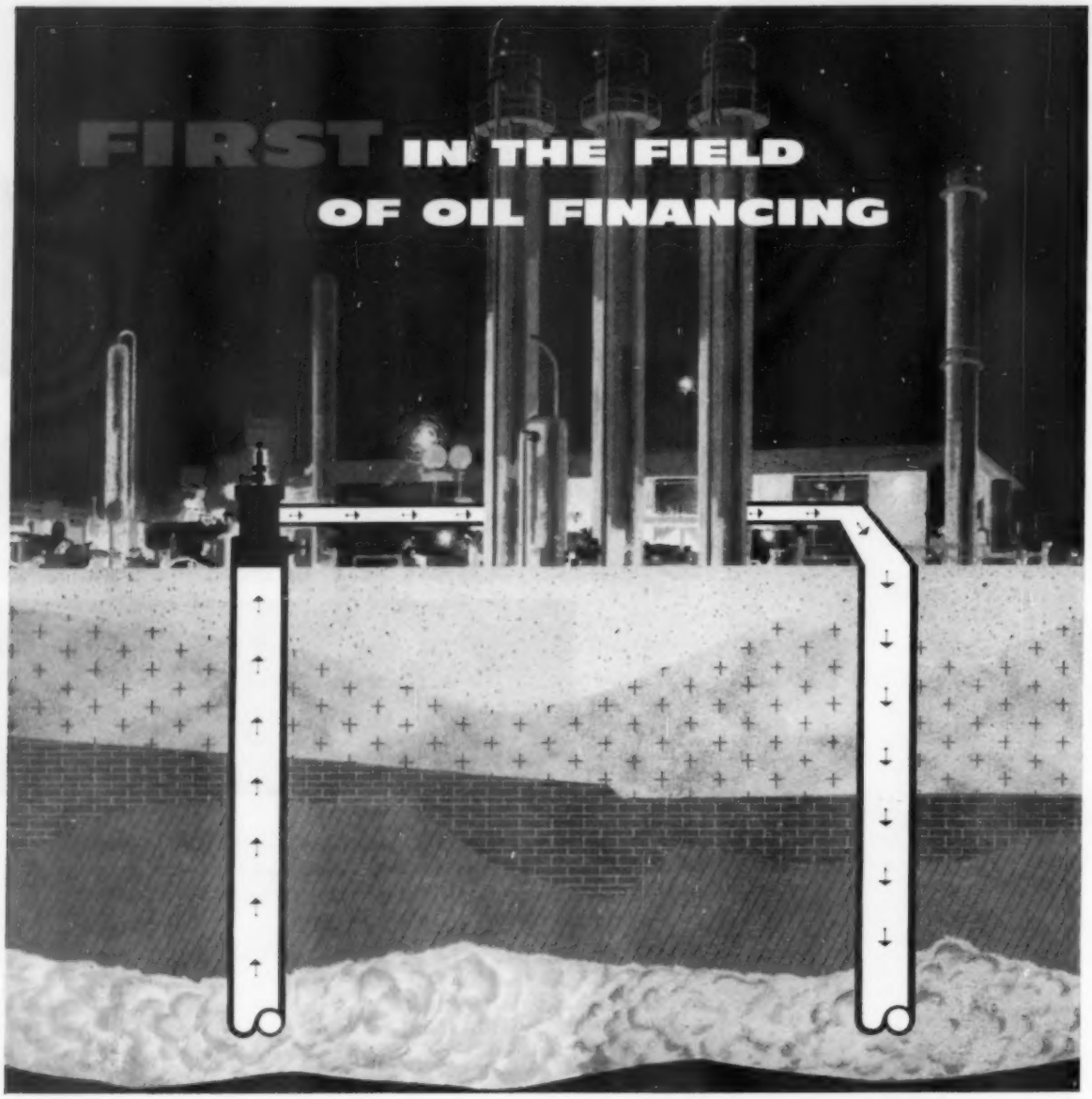
OFFICES IN ALL PRINCIPAL OIL AREAS

Ultra Fine Diamond Equipment for the Oilfield

TRUCO DIAMOND BITS

Drilling & Service INC.

World-Wide in Scope — Local in Know How and Service



Let your plans include the specialized knowledge and resources of the nation's Pioneer Oil Bank.

84th Year of Dependable Service

FIRST NATIONAL BANK IN DALLAS

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DU PONT *Petroleum Chemicals* NEWS

Number 96 in a Series of Bulletins for the Petroleum Industry

MAY-JUNE 1959

Refiner cuts TEL unloading time in half with help from Du Pont

To solve specific problems, Du Pont offers most fully rounded line of additives

Each of the additives in Du Pont's complete line was developed to overcome a precise problem or add a performance "extra" to your petroleum product. For example . . .

1. Tetraethyl Lead—For highest octanes at lowest cost. To give you fast, dependable delivery, Du Pont maintains ample stocks at 25 distribution points throughout the U.S., convenient to refiners everywhere.

2. Fuel Oil Additive No. 2 — Improve your fuel oils with Du Pont FOA-2, the additive which stabilizes heating oils, diesel fuels and residual stocks.

3. Du Pont Dyes—A complete line of oil colors for identifying grades, meeting legal requirements and for adding brand identification to your gasoline, fuel oil, lubricants and other petroleum products.

4. Du Pont Metal Deactivator—Combats copper-caused gum in gasolines, and sludge and gel formation in fuel oils.

5. Du Pont Metal Suppressor—A newly developed product uniquely effective for coating copper parts in hydrocarbon systems and thus suppressing solution of the metal into the product.

6. Antioxidants—Protect gasolines from oxidation and gum formation. Complete line offers antioxidants for every purpose, every refinery stock.

7. "Ortholeum"® 300 — Stabilizes and protects greases. It offers the combined advantages of metal deactivation and antioxidant action.

8. Additives for industrial oils and lubricants—Three widely used and highly effective additives for improving the performance and stability of industrial oils and lubricants are:

"Ortholeum" 162 lubricant assistant
PAN (phenyl-alpha-naphthylamine)
PBN (phenyl-beta-naphthylamine)

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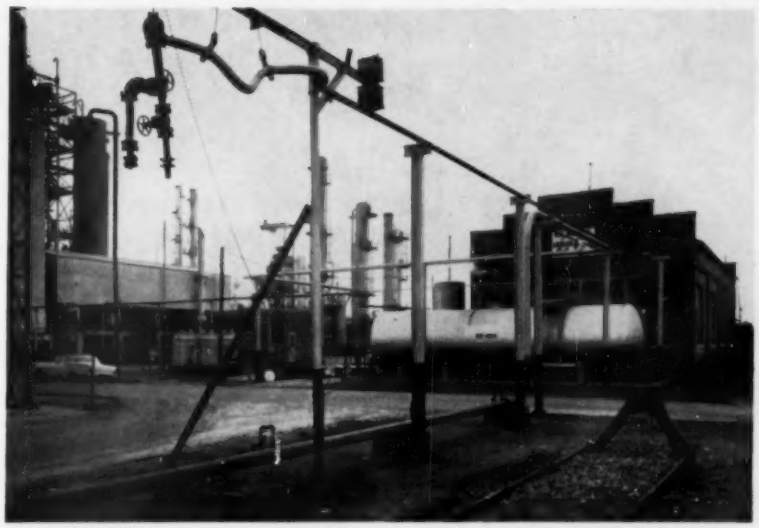


IMPROVEMENTS over an old tetraethyl lead unloading line, suggested by Du Pont engineers, made it possible to lift TEL more than 16 feet from tank car to storage level. The new line has cut unloading time in half. An additional advantage is that the new line handles both motor mix and aviation mix, thereby saving some $50,000 in unneeded new equipment. Furthermore, because of the improved time factor, one shift instead of two handles all unloading.

Changes recommended by Du Pont engineers have boosted the unloading rate at one refinery from 340 lbs/min to 800 lbs/min.

Unloading time required for 6000-gallon tank cars has dropped to less than two hours. With the old setup it took from four to six hours to unload the same cars.

The switch involved was from an old two-inch line with numerous valves and fittings to a simplified three-inch line having only two valves, two ammonia elbows and three ammonia tees.

The new design was based on careful calculations of pressure drop in both the old and proposed systems by the Du Pont representative. He then advised on the construction, tested and helped to start the operation of the new system, working at all times with the refinery engineering department.

Are you taking full advantage of Du Pont engineering know-how?

You'll find Du Pont ready to go a long way in custom-engineering service to help you solve problems involving tetraethyl lead and other petroleum additives.

Customer requests for service in the past have led to such Du Pont developments and innovations as the siphon starter, valves trimmed with "TEFLON,"® Metal-Flex unloading hose, dry dye eduction systems, and a host of other developments now widely applied in the industry.

How can you get Du Pont service?

You start by phoning or writing to the Du Pont sales office nearest you (see list on back of this page). You'll get prompt and thorough attention.

®"Teflon" is Du Pont's trademark for its TFE-fluorocarbon resin.

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER

DU PONT *Petroleum Chemicals* NEWS

CONTINUED **Complete Line**

Service also is available for the selection and handling of these additives, and in training your blending plant personnel. Your Du Pont Petroleum Chemicals representative supplies these and many other services. He's backed by a large staff of specialists in research, training, production, safety, sales promotion and advertising, men who have devoted long careers to cooperating with refiners.

Write for more information.

WEST COAST REGIONAL MANAGER

ROBERT F. HARWICK is manager of the Du Pont Petroleum Chemicals Western Region.

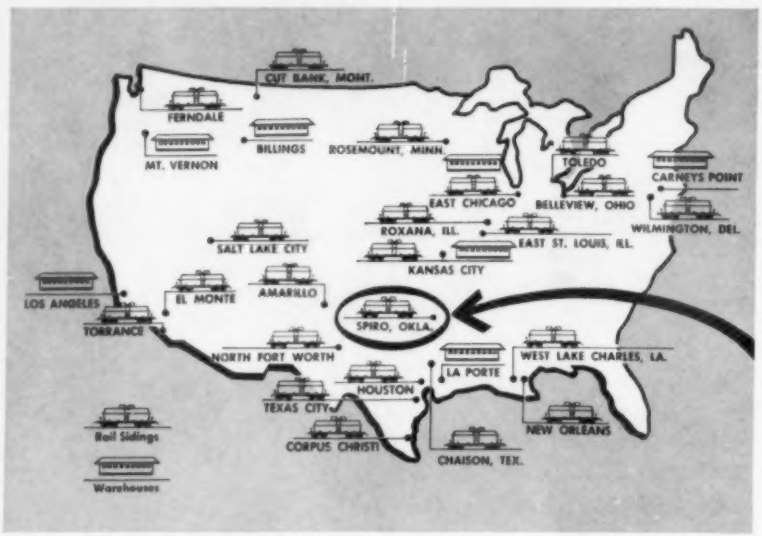
He's in charge of a variety of activities west of the Rockies. These include a Regional Sales office in Los Angeles, District Sales offices in Seattle and San Francisco, a regional laboratory and a tetraethyl lead terminal at El Monte, California, as well as additives warehouses and railway distribution centers at Ferndale, Washington; Port Costa, Antioch, Torrance, and El Monte, California; and Salt Lake City, Utah.

The new Du Pont TEL plant at Antioch makes available the TEL sold by Mr. Harwick's group.

Prior to this assignment, Mr. Harwick was the assistant manager of the Du Pont Elastomers Department's Akron office.

He brings to his job a broad range of oil industry experience, covering phases all the way from manufacturing to editorial work with a petroleum publication.

A graduate of Drexel Institute with a B.S. degree in Chemical Engineering, Mr. Harwick served for four years with the U. S. Army during World War II.



New TEL Sidetrack in Oklahoma

Now there are 22 points from which you can get emergency shipments of Du Pont TEL.

To provide even faster service to customers in Oklahoma and Southern Kansas, we are now keeping TEL on hand at a new siding at Spiro, Oklahoma.

Ample supplies of both motor mix and aviation mix are always ready to roll from all 22 sidetracks shown above. There's someone at the phone night and day at each point, ready to expedite your emergency orders.

There are also truck terminals at Carneys Point, New Jersey; Antioch and El Monte, California; Beaumont, Texas; and Ferndale, Washington, complete with weigh tanks and storage facilities, so that you can order rush shipments of TEL in less-than-tank-car quantities.

For further information on service from any of these points, contact the Du Pont Sales office listed at the right which is nearest you.

How far are you from a Du Pont additives warehouse?

Each of the seven warehouses shown on the map above is ready to make rush deliveries on any Du Pont petroleum additive whenever the need arises.

All seven maintain ample stocks of all our additives, including Du Pont Metal Deactivator, antioxidants, dyes, fuel oil additives, and grease stabilizers.

Contact any of the sales offices listed below for fastest service.

SALES OFFICES

Chicago 3—8 So. Michigan Ave. . . . . RAndolph 6-8630
Cleveland 15—101 Prospect Ave. . . . . MAin 1-3422
Houston 2—
705 Bank of Commerce Bldg. . . . . CApitol 5-1151
Los Angeles 17—612 So. Flower St. . MAdison 4-1354
New York 20—
45 Rockefeller Plaza . . . . . COlumbus 5-2342
Philadelphia 2—3 Penn Center Plaza . . LOcust 8-3531
Pittsburgh 22—1 Gateway Center . . . ATlantic 1-2933
San Francisco 4—111 Sutter St. . . . . EXbrook 2-1934
Seattle 3—4003 Aurora Ave. . . . . MElrose 2-6977
Tulsa 1—1811 So. Baltimore Ave. . . . . LUther 5-5578
In Canada—Du Pont of Canada Limited, Petroleum Chemicals, 85 Eglinton Ave. East, **Toronto 12**—Ontario . . . . . HUdson 1-6461
OTHER COUNTRIES: Petroleum Chemicals Division, Export Sales, Wilmington 98, Delaware, PRospect 4-2962.

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Better Things for Better Living
. . . through Chemistry

Du Pont Tetraethyl Lead and other Petroleum Additives

OVER

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

A-10740

Printed in U.S.A.

Sherman's 1959 Panther Power Digger

with All New Loader Attachment

Here's the digger that makes all others obsolete. The improved Panther blends feature knowledge from over 17,000 installations with the imagination and skill of Sherman's research and engineering.

Go Ahead! Compare! Sherman is the Standard of Comparison!

- ★ **Exclusive Sherman Hydra-Loop provides hydraulic power at both ends of tractor simultaneously.**
- ★ **Lightning Detach frees tractor for other jobs in two minutes without special tools.**
- ★ **Dirty Filter Indicator guarantees maximum all-around performance.**
- ★ **Easy oil filter accessibility saves time, eliminates work, simplifies maintenance.**
- ★ **2800 Sherman dealers throughout U. S. and Canada assure you of prompt parts and service for dependable and economical operation.**

AND **. . . for the first time, the all new Sherman Loader is available as companion equipment. With 2000 lbs. lift, 4000 lbs. breakaway capacities. (2500 lbs./5000 lbs. for Ford Industrial or Fordson Power Major tractors.) The improved Panther and new Loader give you an excavating-materials handling unit that outperforms, outmaneuvers any comparable equipment on the market today!**

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SHERMAN PRODUCTS, INC.

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See Your Ford Tractor Dealer Today

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Please send me Bulletin No. 1594 on the Sherman Panther Power Digger and All New Loader.

Name_____

Address_____

City_____ State_____

for TANK FARM Inventory Control

"Varec" Pulse Code

DATA GATHERING AND REDUCTION SYSTEM

For handling such variables as LIQUID LEVEL *(in feet, inches and eighths; metric in millimeters or feet and hundredths);* TEMPERATURE *(one degree increments to three digits);* PRESSURE *(three digits in one or ten pound increments);* FLOW VOLUME *(to five or six digits in one or ten barrel increments or other volume units).* The system will also log the status and provides for the control of operating equipment such as valves, pump motors, etc. Time data and identification points can be recorded as needed to suit the operation. Flexibility is one of the system's outstanding features since it allows the use of standard proven systems for custom applications that would otherwise require special-built, untested units.

FLEXIBLE ARRANGEMENT

Almost any type of logging program can be arranged by using standard sub-assemblies: Logging on prearranged form, with or without point identification, or on random order basis with point identification •••••• Entry of one or more lines of data for log cycle •••••• Time entry at start of each line entry. All numbers, fractions and letters available for logging; carriage shift; black-red ribbon shift provisions.

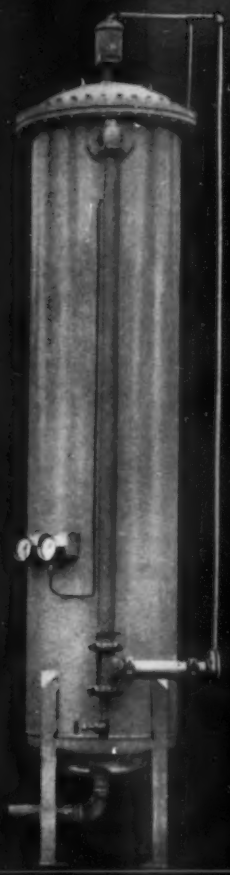
FLEXIBLE OPERATION

Manual operation without Data Logging by means of a telephone dial which obtains a visual indication of any point included in the system ••••• Manual control of Scanning-Logging Cycle can be started at any time by the operator at any desired point ••••• Automatic Control of Scanning-Logging Cycle can be initiated on a time programmed basis by time clock control.

FOR A COMPLETE ENGINEERING APPROACH TO TELEMETERING SYSTEMS REQUEST PACKAGE 24

THE VAPOR RECOVERY SYSTEMS COMPANY • COMPTON, CALIFORNIA

GIVE YOUR NATURAL GAS DRYING COLUMN A FIVE-FOLD BOOST!



More than two years of field service prove it—LINDE Molecular Sieves have five times the drying capacity of silica and alumina—are the most economical desiccants you can use for natural gas drying:

- Molecular Sieves have water capacities in the range of 10% to 15% by weight. This compares with 2% to 3% when drying pipeline gas—and 5% to 8% when drying field gas—with silica and alumina type desiccants.
- Molecular Sieves reduce effluent water concentrations three-fold.

The high capacity of Molecular Sieves in your present equipment will allow you to increase throughput without the expense of new drying towers.

Besides solving your drying problems, Molecular Sieves will also sweeten your natural gas stream—you get a single desiccant system that removes all three impurities—water, hydrogen sulphide, and mercaptans.

For further information on LINDE Molecular Sieves, contact your nearest LINDE office or write Linde Company, 30 East 42nd Street, New York 17, N. Y. *In Canada:* Linde Company, Division of Union Carbide Canada Limited. Address Dept. 0-61

Linde UNION CARBIDE

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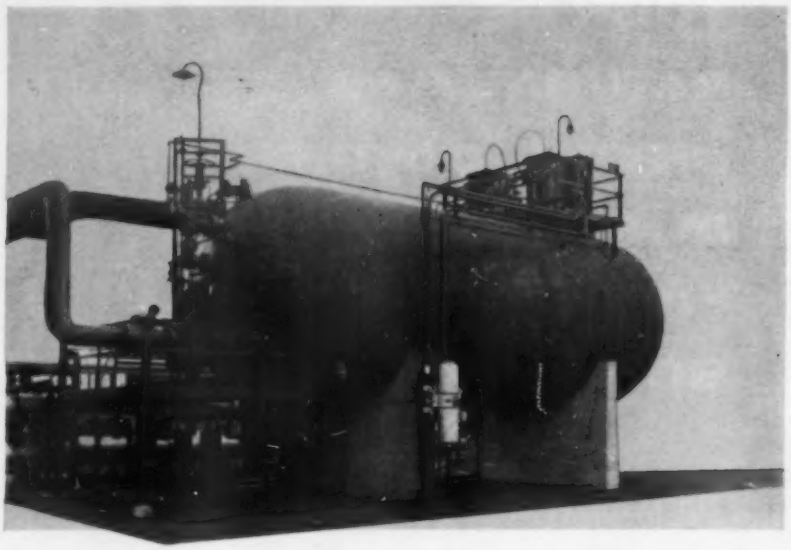
PRODUCT IMPROVEMENT WITH

PETRECO



facts to consider

WHEN YOU SPECIFY DESALTING EQUIPMENT

1 EFFICIENCY IS MEASURED IN TERMS OF REMAINING IMPURITIES. The ultimate measure of any desalting process is its thoroughness in removing salts and impurities—*not how much salt is removed, but how much salt is left in.*

PETRECO* all-electric desalters consistently deliver desalting results with residual impurities in the 0 to 1 ptb range.

2 SALT "SETTLING" IS NOT TRUE DESALTING. Salt settling is one way to remove salts, but desalting is something else. "Settling", using long "residence time" in large volumetric capacity settlers, was one of the first methods ever used to remove salts.

Petreco all-electric desalting is an engineered method for the extraction of salts from crude oil. The mixture of the oil and salt-bearing brine is combined precisely with the correct amount of fresh water, and exposed to the powerful forces of the electric field to achieve fast, efficient separation.

3 TIME, DISTANCE AND SETTLING SPACE ARE NOT IMPORTANT FACTORS IN PETRECO ALL-ELECTRIC DESALTING. These natural developments are vital only to desalting methods wherein settling is necessary to the functioning of the process.

In Petreco all-electric desalting, engineered emulsification, distribution and demulsification bring about rapid, controlled action.

Because of this, Petreco desalters are usually smaller than vessels used in less advanced methods. This means savings in the cost of the vessel required, the amount of piping and the ground area needed—and yet provides a maximum yield in salt removals.

Remember—when you specify your next desalting installation, there is no substitute for Petreco's engineering design.

*PETRECO *is a registered trade mark of Petrolite Corporation.*

DS-59-1

PETROLITE CORPORATION

PETRECO DIVISION

3202 South Wayside Drive (P.O. Box 2546), Houston 1, Texas
1390 East Burnett Street (P.O. Box 7216), Long Beach 7, California

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ENGLAND: Petrolite Limited, 46 Mount Street, London, W. 1

VENEZUELA: South American Petrolite Corporation, Hotel Avila, Caracas

REPRESENTATIVES

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JAPAN: Chiyoda Chemical Engineering and Construction Company, Ltd., Tokyo Bldg., No. 3, Marunouchi 2-Chome, Chiyoda-Ku, Tokyo
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MEXICO: R. E. Power, Sierra de Mijes, No. 125, Mexico D. F.
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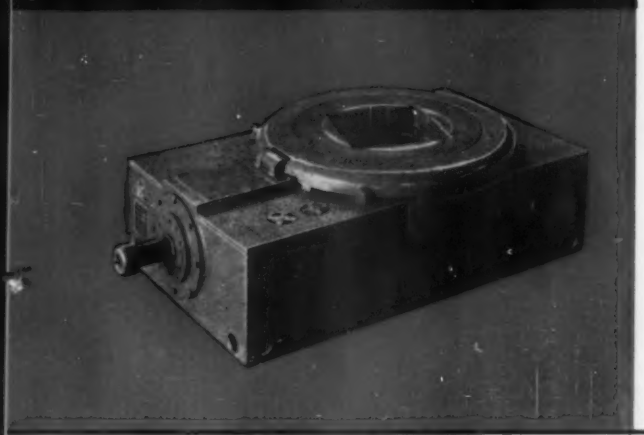
CONTINENTAL-EMSCO

SWIVELS AND ROTARY TABLES

MATCHED TOGETHER FOR DRILLING HARMONY



Continental-Emsco Swivels

Whether you are drilling in remote areas or right in town, you'll drill more hole with less maintenance with C-E Swivels. An exclusive, easy-to-replace, one-piece cartridge washpipe packing extends the life of both . . packing and washpipe. C-E Swivels have high capacity and yet are slimmed down with less bulk and weight for easier handling on the derrick floor.

Continental-Emsco Rotary Tables

Continental-Emsco Rotary Tables thrive on rough drilling conditions. They're able to operate 24 hours a day anywhere in the world with a minimum amount of downtime. Field-proven features give them this extra stamina . . make them smoother running, safer, more efficient. They're compact . . easy to handle and install at the rig. Each table is proof-tested under load before being shipped.

Your Continental-Emsco representative has all the data on this equipment . . call him today.

For Service that Sings . . Equipment that Hums . . Go . .

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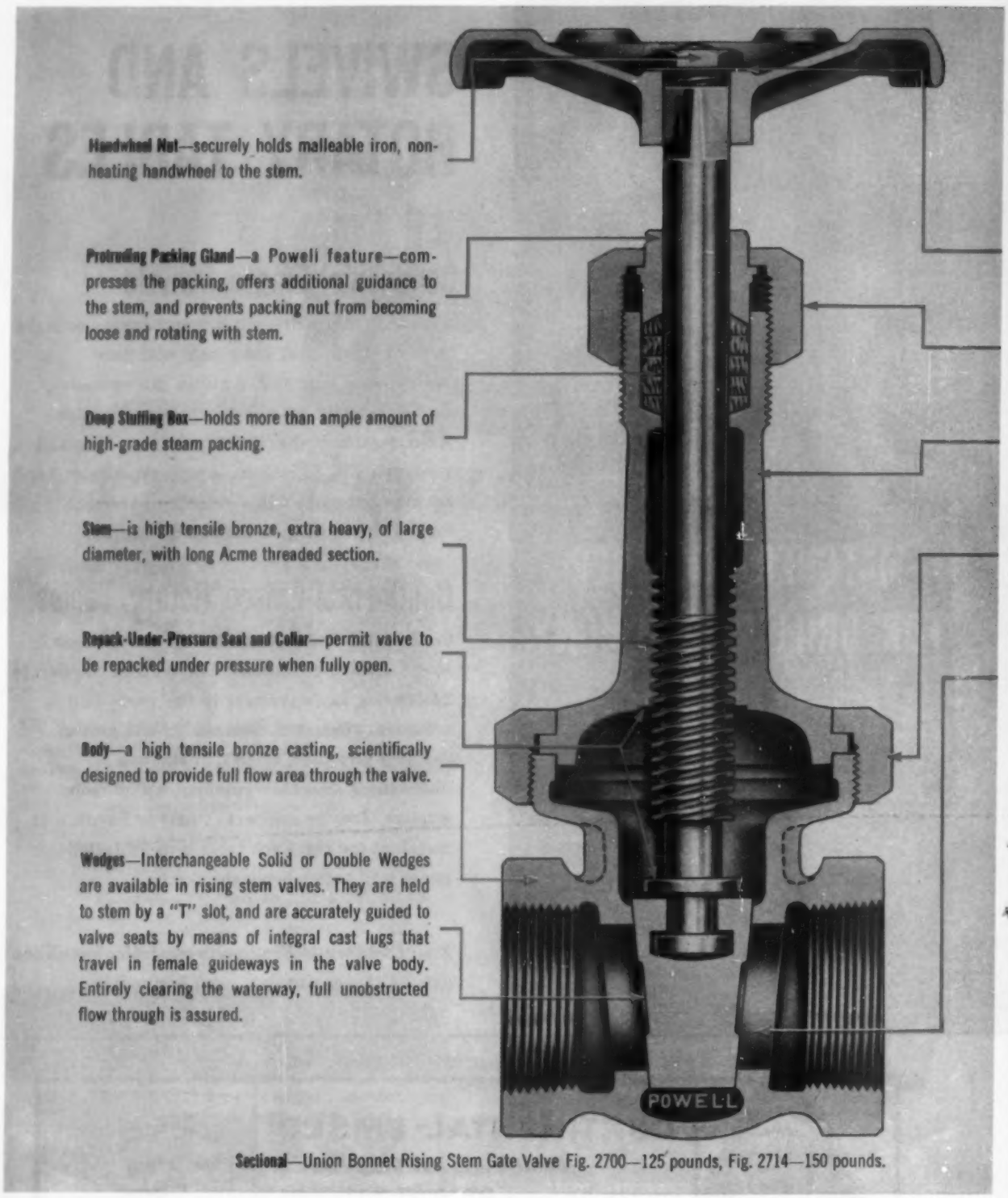
ANNOUNCING NEW **POWELL**


Handwheel Nut—securely holds malleable iron, non-heating handwheel to the stem.
Protruding Packing Gland—a Powell feature—compresses the packing, offers additional guidance to the stem, and prevents packing nut from becoming loose and rotating with stem.
Deep Stuffing Box—holds more than ample amount of high-grade steam packing.
Stem—is high tensile bronze, extra heavy, of large diameter, with long Acme threaded section.
Repack-Under-Pressure Seat and Collar—permit valve to be repacked under pressure when fully open.
Body—a high tensile bronze casting, scientifically designed to provide full flow area through the valve.
Wedges—Interchangeable Solid or Double Wedges are available in rising stem valves. They are held to stem by a "T" slot, and are accurately guided to valve seats by means of integral cast lugs that travel in female guideways in the valve body. Entirely clearing the waterway, full unobstructed flow through is assured.
POWELL

Sectional—Union Bonnet Rising Stem Gate Valve Fig. 2700—125 pounds, Fig. 2714—150 pounds.

POWELL...world's largest family of valves

BRONZE UNION BONNET GATE VALVES

for 125 and 150 pounds WSP

These new BRONZE Union Bonnet Gate Valves have many superior features—some of which are outlined here. For complete details, write for new illustrated circular. Or check with your nearest Powell Valve distributor.

Identification Plate—gives Figure Number and kind of valve.

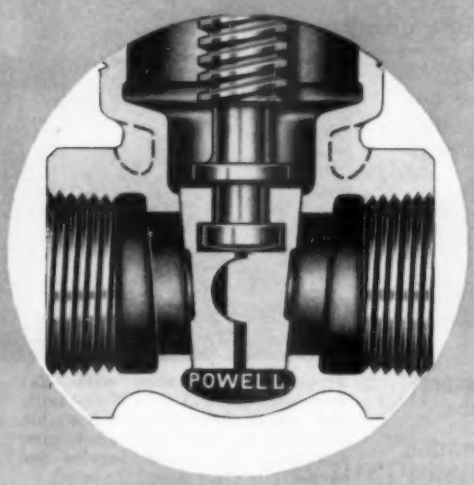
Heavy Hexagonal Packing Nut—for holding gland and adjusting packing.

Long Bonnet—cast of high tensile bronze for long service.

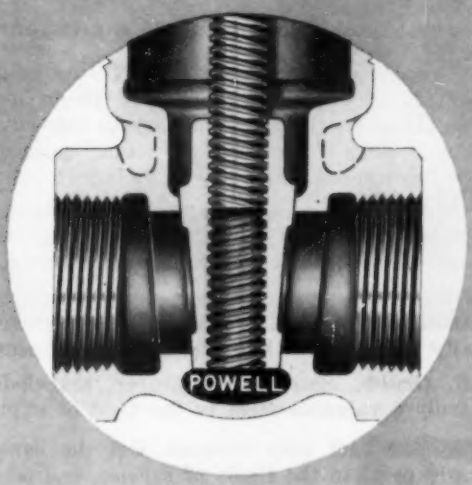
Octagonal Ring Nut—is deep threaded and tightly holds body-bonnet connection. Affords additional wrenching positions.

Ample Space—between seats and end of pipe thread prevents injury to seats when screwing pipe into the body.

Fig. 2707—125-pound Union Bonnet Non-Rising Stem Gate Valve. Also available for 150 pounds—Fig. 2712.

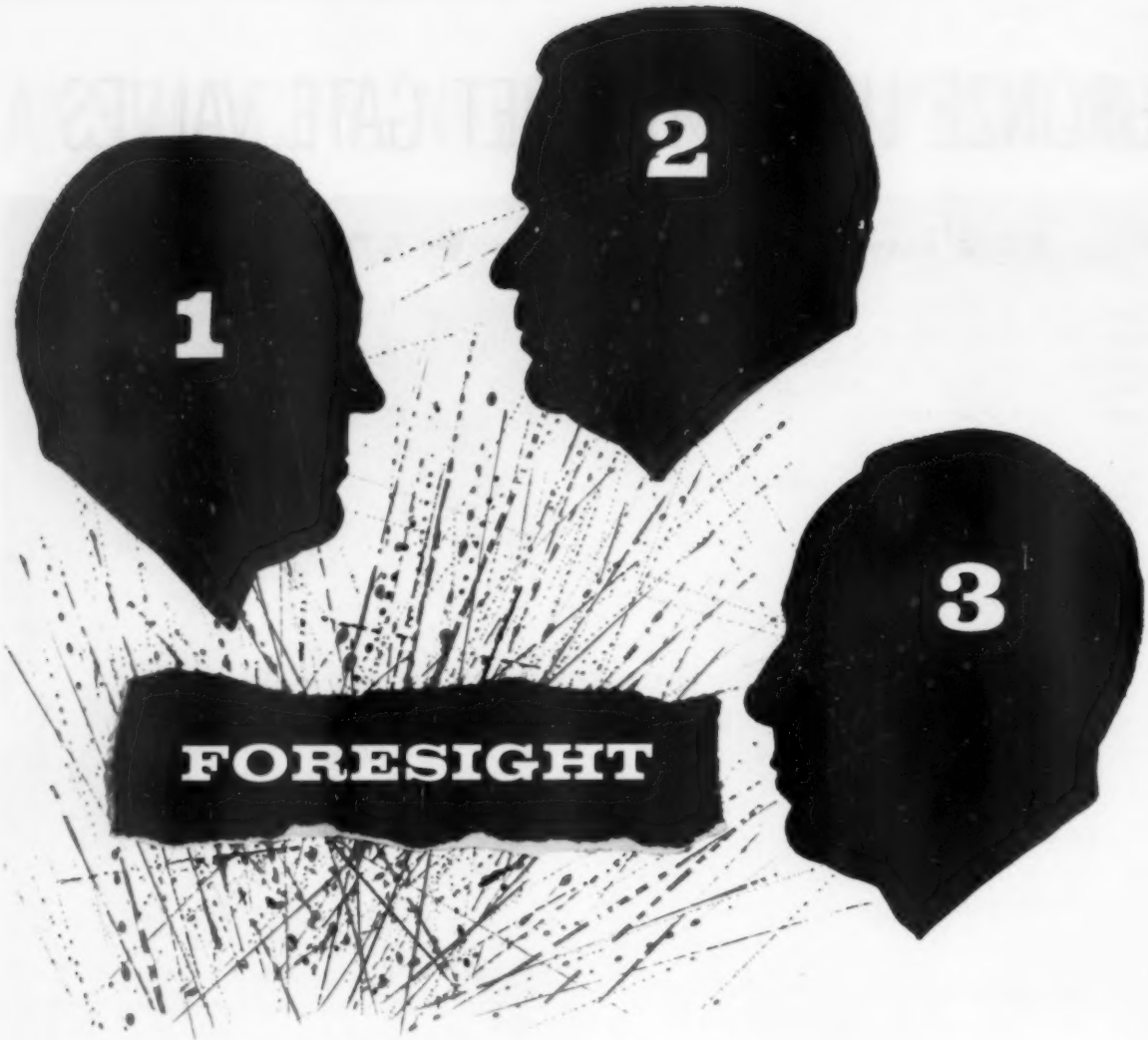


Detail of Sectional View Inside Screw Rising Stem Gate Valve showing Double Wedge Disc and Integral Seats.



Detail of Sectional View Non-Rising Stem Gate Valve showing Solid Wedge Disc that rises on stem. Integral Seats.

THE WM. POWELL COMPANY • *Dependable Valves Since 1846* • **Cincinnati 22, Ohio**



In every field, look-to-the-future management makes one company a leader

General Geophysical Company is recognized in all oil areas as the pace-setter in geophysical exploration. Each General employee has played a part in putting the company in this envious position. But, the prime responsibility rests on sound, progressive management. General's foresighted management includes:

1 *Chester Sappington:* Chairman of the Board, an oil exploration authority with 27 years 'round-the-world experience; noted for his knowledge of Gulf Coast and South American fields.

2 *Tom Hall:* President, an outstanding geophysicist with 32 years international oil exploration experience; recognized for his first-hand familiarity with all North American oil provinces.

3 *A. B. Grubb:* Secretary-Treasurer, knowledgeable and experienced; truly a valuable asset in the field of exploration finance.

Place your contract with General. Get the benefits of exploration experts. Experts in the fields of service, equipment, and finance.

Frequent conferences with Research Chief Dr. Lewis Mott-Smith and active field personnel enable General's management team to give you more and better service for each exploration dollar invested.

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WHEN YOUR CONTRACT IS WITH GENERAL, THE PERCENTAGE FOR SUCCESSFUL EXPLORATION IS IN YOUR FAVOR

See our exhibit at the 5th World Petroleum Congress Exposition, June 1-5, 1959 Booth 664

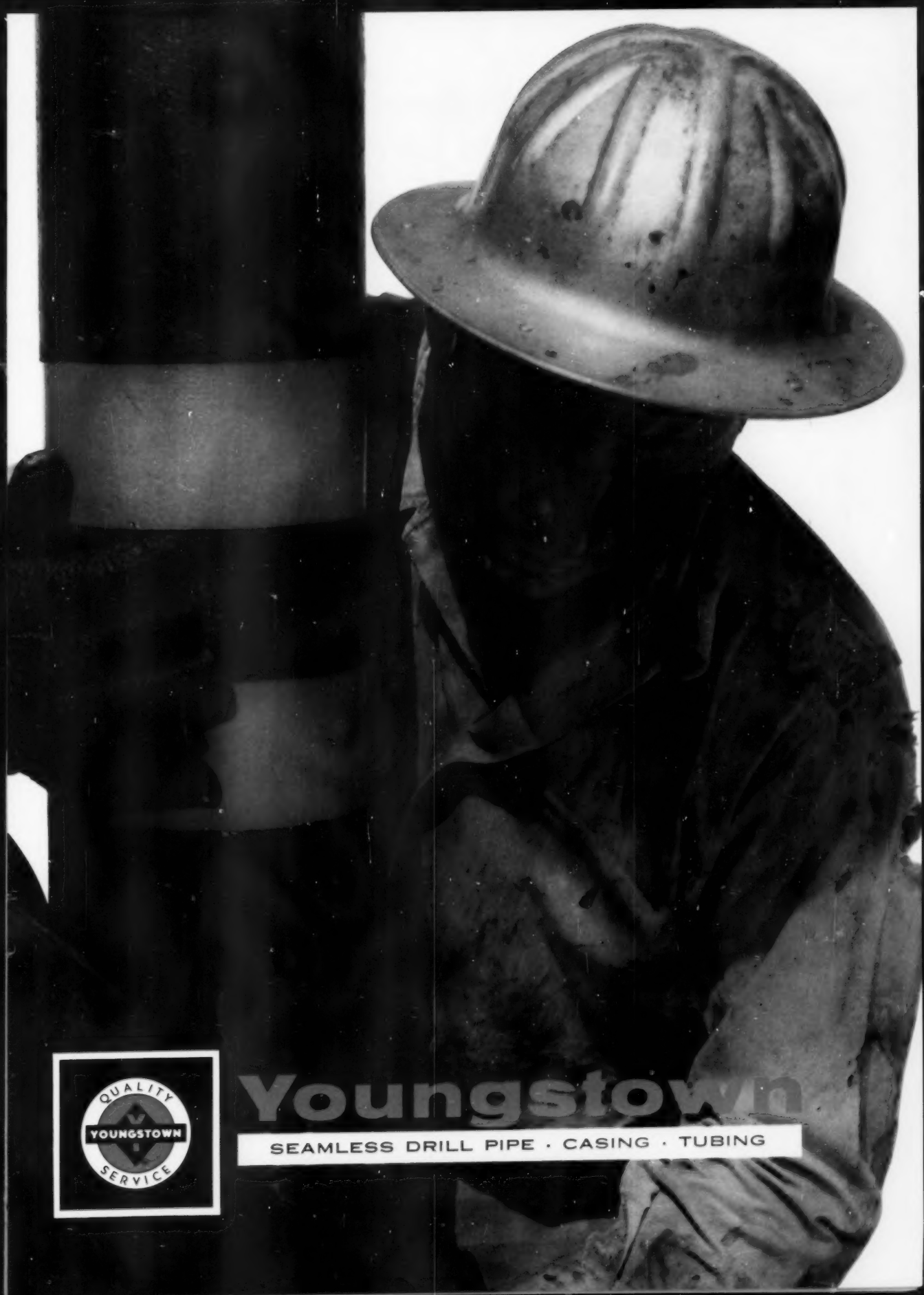
Papua. A route to a new drilling site is prepared. The British Petroleum Company's search for oil is a world-wide operation.

BP

WHEREVER YOU FIND PIPE WITH ORANGE BANDS YOU'LL FIND A SMART PIPE BUYER

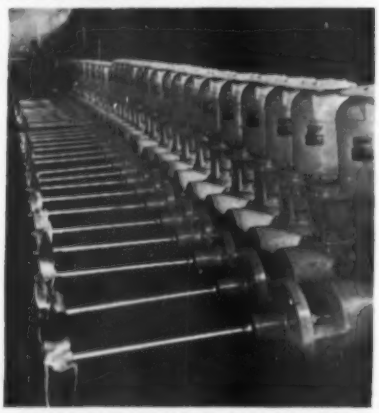
Youngstown's Oil Field Service Corps—nine qualified engineers—stand ready around-the-clock to consult on all your drilling problems. These professional men have offices in the oil fields and will gladly lend you their knowledge and long experience—either prior to drilling or during actual operations. They can tell you, too, about the pipe with the orange bands, the finest seamless pipe made anywhere. Call your nearest Youngstown District Office, today.

THE YOUNGSTOWN SHEET AND TUBE COMPANY
Youngstown 1, Ohio


QUALITY
YOUNGSTOWN
SERVICE
Youngstown
SEAMLESS DRILL PIPE · CASING · TUBING

when you have the Right Motor doing precisely the Right Job . . .

THAT'S EFFICIENCY -- COST CUTTING EFFICIENCY!



Inside Or Out -- Continental

OIL INDUSTRY MOTORS

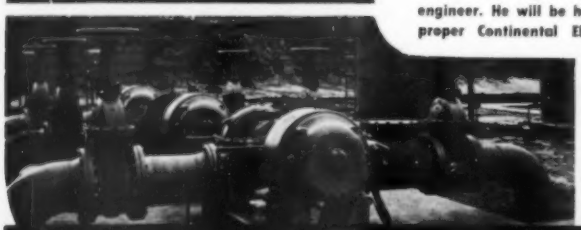
Cut Operating Costs - Reduce Maintenance and Work Stoppage to the Minimum!

Continental Electric Motors are designed and produced in a wide selection of rugged units — each specifically designed to do its job best. Exteriors are virtually weather and element proof. And, inside, they combine the ultimate in oil industry requirements with superior Continental Engineering skill. When you harness the proper Continental for the particular job — you have a combination of smooth power, 24-hour-a-day perseverence and production performance unequalled by any other make. It is these characteristics, built in by Continental, that assures you of always getting top performance, longer life and greater savings with a Continental Electric Motor.

And — because Continental always keeps a stock of motors of all types on hand, shipments are quick and prices are low. Where a custom motor is needed, your requirements are given immediate attention.

From 1 H. P. to 700 H. P. — for the hottest, driest, dirtiest field operation — or for the most exacting, gruelling refinery requirement, there is a Continental Electric Motor precisely built for your precise needs. And, when you have the precise Continental Motor for the precise job—you have the maximum in efficiency and low operating costs.

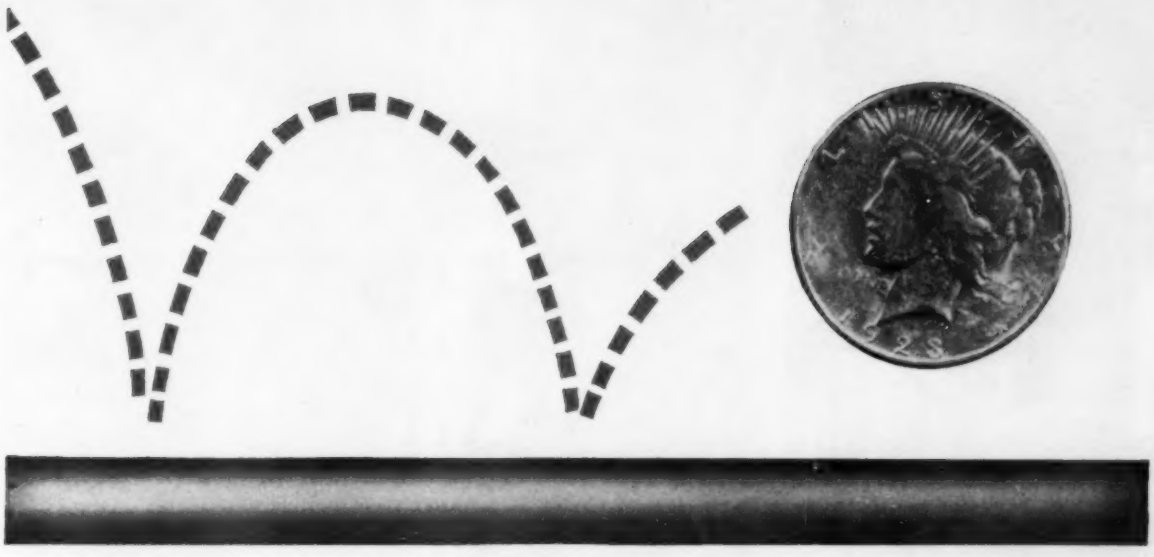
Contact our nearest factory trained representative-engineer. He will be happy to help you select the proper Continental Electric Motor to do your job best.



Continental *Electric Co., Inc.*

Plants at: NEWARK 5, NEW JERSEY and ROCKFORD, ILLINOIS

TEX-TUBE lightwall pipe makes your pipeline dollar go farther



Take strength. Tensile strengths and working pressures of Tex-Tube Lightwall Pipe equal those of standard weight pipe of the same I.D.

Consider corrosion. If pipe wrap and cathodic protection are doing their job, why do you need a heavy wall?

In short, why buy "protection" you can't use? It's costing you plenty.

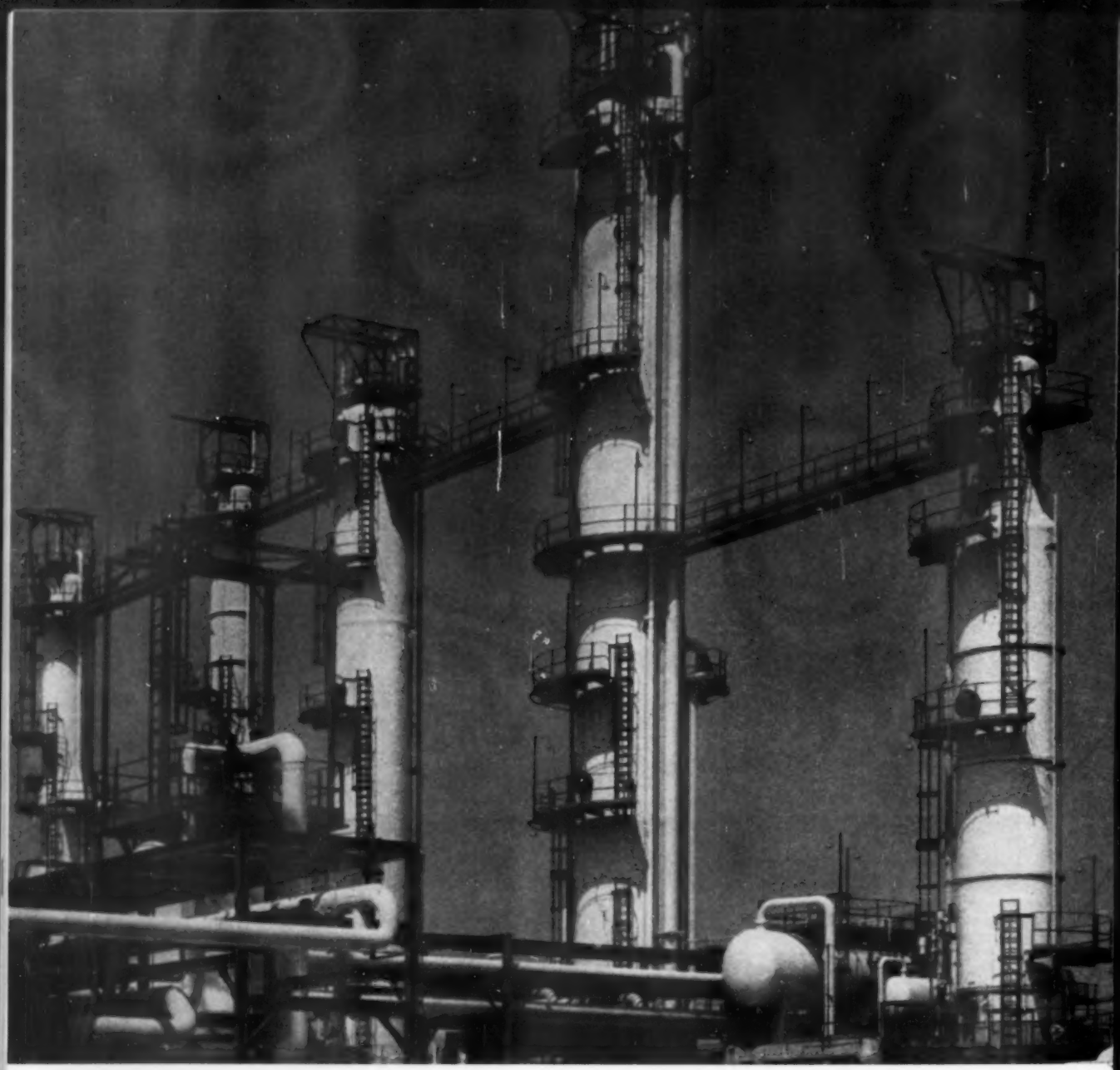
No wonder the trend is to money-saving, fully-proven Tex-Tube Lightwall Pipe.

TEX-TUBE, INC.

1503 NORTH POST OAK ROAD • HOUSTON, TEXAS

Sales Offices in Midland, Texas—Tulsa, Oklahoma—Baton Rouge, Louisiana—Los Angeles, California

LICENSED BY THE AMERICAN PETROLEUM INSTITUTE



Third New Platformer for Gulf...

COLUMNS BY

GRAVER®

The third of three new 26,000 b/d Platforming® units to be installed by the Gulf Oil Corporation is now on stream at Gulf's Port Arthur refinery. Built under license from the Universal Oil Products Company, this latest installation will substantially increase the high octane potential at the refinery.

The five large columns above and two separator units were shop-fabricated at Graver's East Chicago plant and erected by Procon Incorporated, the general contractor. Eighteen columns for the other two Platforming unit installations at Gulf's Philadelphia refinery were also shop-fabricated at Graver's East Chicago plant.

Large or small processing equipment for petroleum, petrochemical, chemical and nuclear energy installations are produced with dispatch and skill by Graver artisans. Graver's century of experience means quality construction.

GRAVER TANK & MFG. CO. EAST CHICAGO, IND.
DIVISION—UNION TANK CAR COMPANY

PLANTS AND OFFICES ACROSS AMERICA

PTA WORK AND BEING A CUB SCOUT DEN MOTHER help to keep Mrs. William R. Hugill of Livonia, Michigan, busy. In addition, Mrs. Hugill, like many wives of Standard Oil dealers, helps her husband with the office work necessary for an efficient operation.

We want you to meet some of our fair ladies

THE OTHER DAY someone remarked that the oil business was only a man's business. It isn't true—and thank heaven for that! Thousands of women have played a vital role in making Standard Oil what it is today—stockholders, employees, wives of employees, businesswomen and dealers' wives.

Here are just a few of our fair ladies. There isn't enough room on this page to print all of their pictures.

Women have an unerring instinct for quality and service and value—things on which our business is built. This is why so many women are busy *on* the scene at Standard Oil. But we are equally grateful to wives and mothers *behind* the scene. They know how to ladle out generous portions of praise and encouragement—just when they're needed the most. Progress depends on perseverance. And we count on thousands of the best bucker-uppers in the world!

A "man's business," indeed!

MISS MARY GARVEY IS A SCIENTIST in our research center at Whiting, Indiana. A graduate of Purdue University, her branch in science is chemistry. She is conducting one of hundreds of experiments that go on here continually to improve petroleum products.

MISS AGNES TOKHEIM is president of The Tokheim Company, Cedar Rapids, Iowa. Her company manufactures and sells gauges to Standard Oil. More than 30,000 independent businesses supply Standard with the services and materials needed to give you top-notch service.

BEFORE HER RECENT RETIREMENT, Miss Flora Adler was executive secretary to a Standard Oil official. An employee of Standard for more than 22 years, she is now on a world tour. Back in 1903, when retirement benefits were virtually unheard of in industry, Standard Oil started its retirement plan.

MISS MARGARET JOHNSON, an assistant principal in a Chicago high school, is shown going over a problem with George Mitchell (left) and Tom Madden. Miss Johnson is one of more than 53,000 women who own stock in Standard Oil. Standard has paid dividends in 66 consecutive years.

1959 — 50th ANNIVERSARY OF THE OIL INDUSTRY — 75th ANNIVERSARY OF STANDARD OIL CO.

STANDARD OIL COMPANY
(INDIANA)

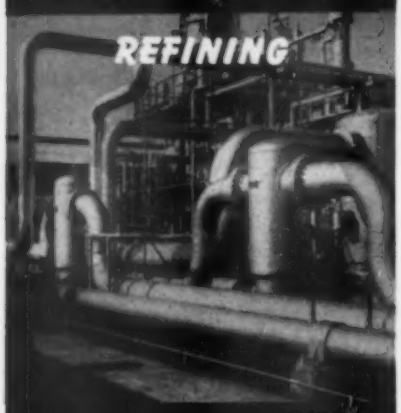
STANDARD

THE SIGN OF PROGRESS...
THROUGH RESEARCH

PRODUCTION

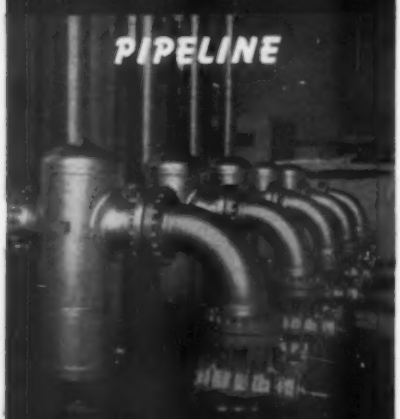
Pictured above is a Peerless Line Separator removing moisture from fuel to drilling rig.

REFINING



These two Peerless Line Separators are doing an efficient job of mist extraction in the Petrochemical plant in Kentucky.

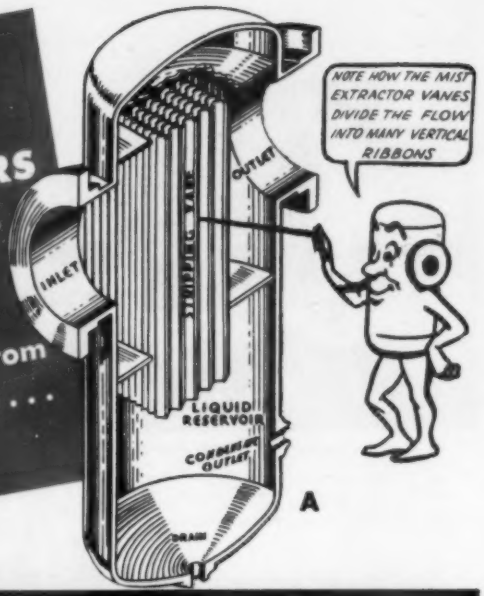
PIPELINE

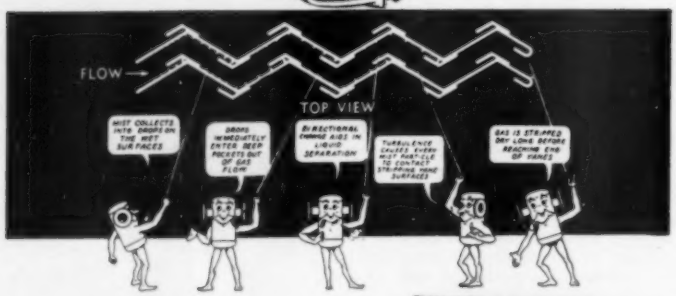


FIVE Peerless Line Separators are shown above as they handle carry over from large scrubbers.

PEERLESS LINE SEPARATORS

Outstanding for the efficient extraction of liquid mist from gas or steam . . .





HIGH EFFICIENCY—HIGH CAPACITY LOW PRESSURE DROP

Thousands of installations throughout the oil industry . . . production, pipeline, refining and petrochemical . . . prove the Peerless Line Separator principle to be one of the most outstanding methods available for the extraction of liquid gas, steam or air.

Drawing A above shows the arrangement of the vanes in the Separator. Drawing B is an illustration of the Peerless Principle.

The mist extractor combines the forces of impingement, centrifugal motion and surface tension to obtain its high efficiency. The path of the gas, etc., through the unit is constantly bending causing semi-violent turbulence and rolling of the gas against the walls of the vane. Impingement and centrifugal force combine to contact the droplets with the vanes, where they coalesce, and surface tension then causes them to cling to the vane's surfaces. Gravity and the impact of the gas steam then drive the droplets into the pockets where they roll down the vanes and out of the gas stream.

Through the Peerless method of mist extraction, the gas is stripped dry long before reaching the end of the vanes.

there's A PEERLESS SEPARATOR FOR EVERY REQUIREMENT

For any capacity
For any working pressure
For corrosive conditions
With removable vane units
With extra body length
With connections for accessory equipment
For pressure drop requirements of less than 6" water
For any vapor-liquid ratio
For any piping requirement

SPECIAL DESIGN SEPARATORS FOR ANY REQUIREMENT

FOR FURTHER INFORMATION ON THE USE OF PEERLESS LINE SEPARATORS PLEASE WRITE FOR NAME OF NEAREST PEERLESS ENGINEER.

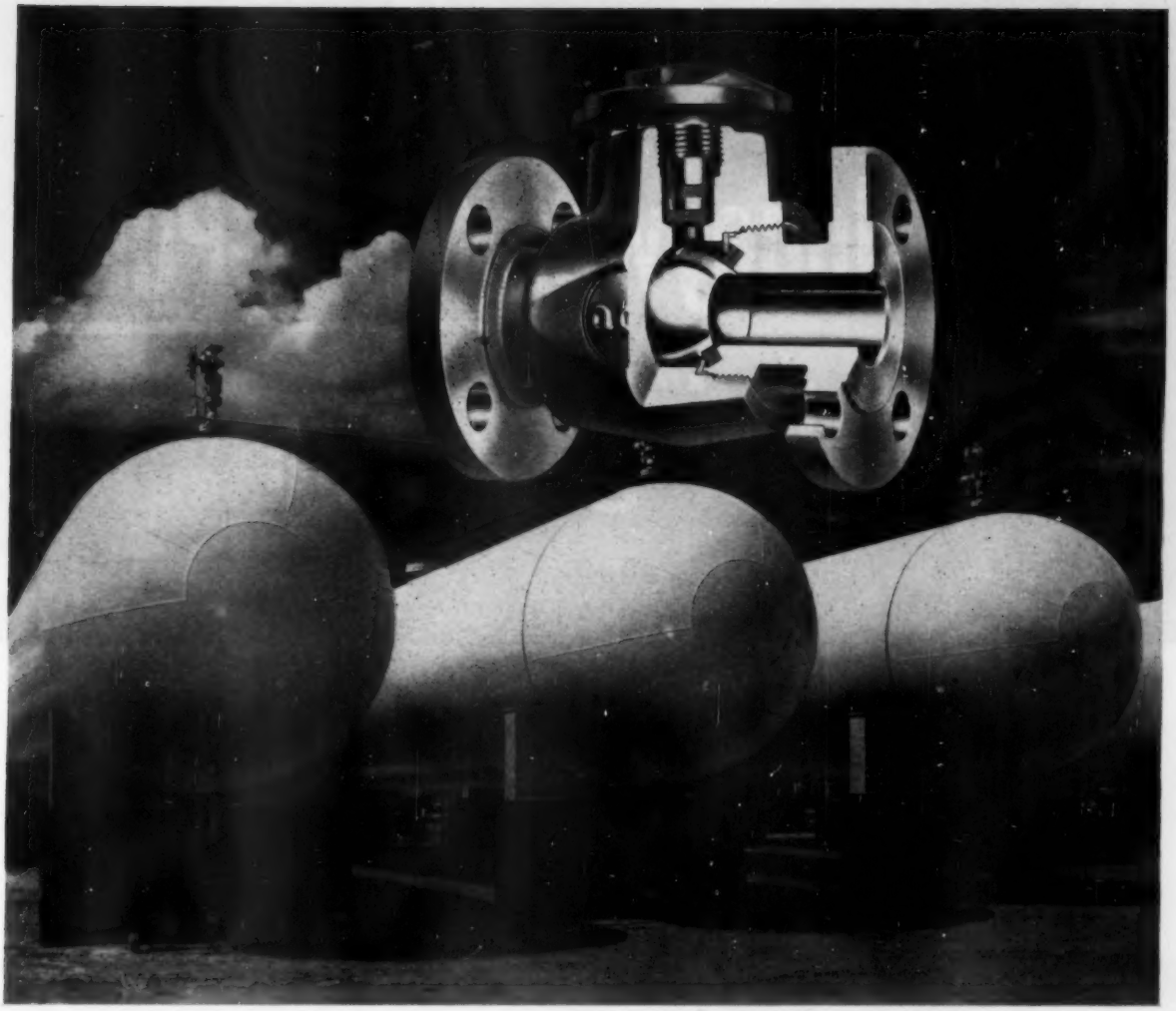
PEERLESS MFG. CO.

"OVER 20,000 SEPARATORS and SCRUBBERS IN SERVICE"

PEERLESS MANUFACTURING CO.

P. O. BOX 13165 ★ DALLAS 20, TEXAS ★ FLeetwood 2-8431

REPRESENTATIVES IN ALL PRINCIPAL CITIES



Valves using durable TFE resins turn easily, seal tight, can't "freeze"

Outstanding success in difficult service applications is typical of valves using components of TEFLON TFE-fluorocarbon resins. For example, over 60 ball valves with no lubricant other than TFE resin are being used in butane-propane service by La Gloria Oil & Gas Company of Falfurrias, Texas. Operating to 300 psi in a system where leakage cannot be tolerated, these valves use seats and stem gaskets of TEFLON TFE resins to assure tight-sealing characteristics and no-stick operation. The valves, manufactured by W-K-M Division of ACF Industries, Inc., have been in operation up to three and one-half years with no reports of leakage or valve failure.

Du Pont TEFLON TFE resins are rated for continuous duty up to 500°F. They are inert to virtually all chemicals encountered in oil extraction and refining and in petrochemical processing. For engineering data and further applications that may suggest uses in *your* processes, write to: E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Dept., Rm. T-3061, Du Pont Building, Wilmington 98, Del.

In Canada: Du Pont of Canada Ltd., P.O. Box 660, Montreal, Que.

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TFE-FLUOROCARBON RESINS

TEFLON is Du Pont's registered trademark for its fluorocarbon resins, including the TFE (tetrafluoroethylene) resins discussed herein.

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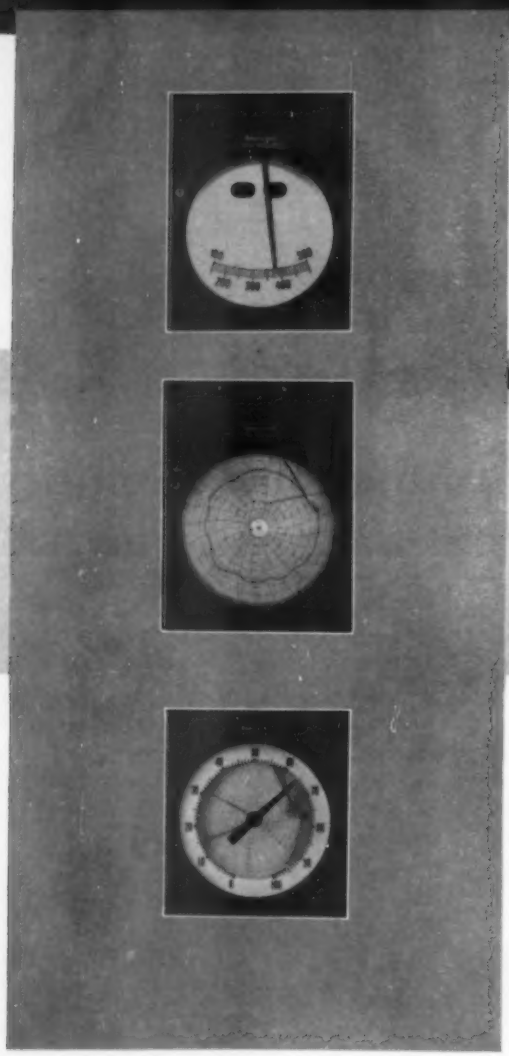
Improve pipeline efficiency with the

new Honeywell Dur-O-Pulse telemetering system



Your choice of transmitters

Eccentric scale indicating transmitter
Single-pen recording transmitter
ElectroniK single-pen recording transmitter

Transmitter features:

- Mechanical or electrical measurements
- Indication and/or recording
- Electric or pneumatic control
- Integration
- Auxiliary contacts
- Remote set controller index receiver
- No load on primary measuring element by either transmitting mechanism or auxiliary contacts

Your choice of transmitter channels

Private wires
Telegraph or telephone circuits
Time multiplexing
Carrier current channels
Tone multiplexing
Radio channels, including microwave, UHF and VHF

Use the new Honeywell *Dur-O-Pulse* telemetering system for fast, accurate, versatile control of natural gas or petroleum pumping stations. It carries process variable measurements up to 100 miles by continuous telephone or telegraph wire pair *without repeaters*, or by microwave, radio or power line carrier systems.

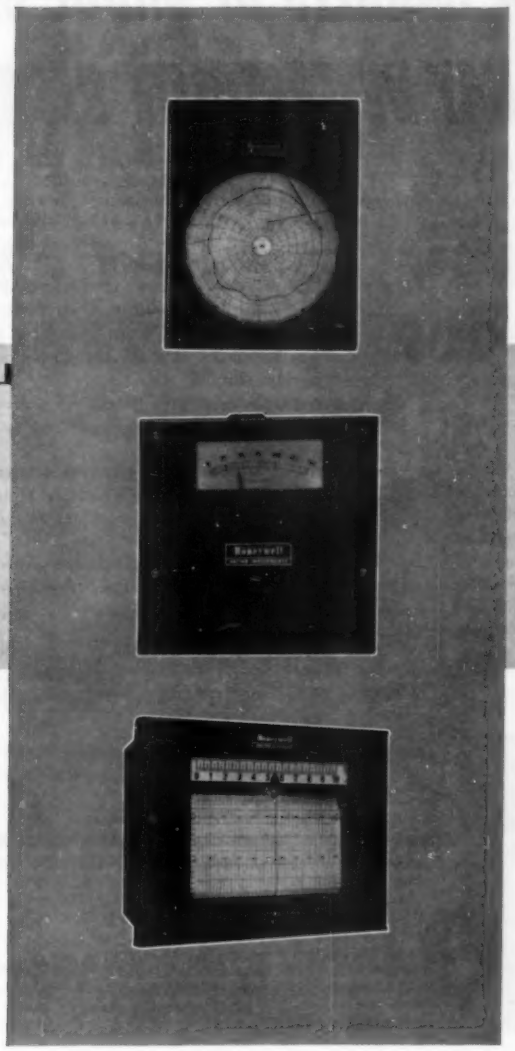
Dur-O-Pulse consists of a transmitter in a standard Honeywell recorder or indicator at the point of measurement, the intervening wiring, a power pack, and a receiver in another Honeywell instrument at the receiving location. Both transmitter and receiver can embody a wide variety of control functions. The system employs the pulse duration technique of telemetering, the simplest, least expensive and most easily maintained of all telemetering systems.

Get complete details from your nearby Honeywell field engineer. Call him today . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pa.

Honeywell

First in Control

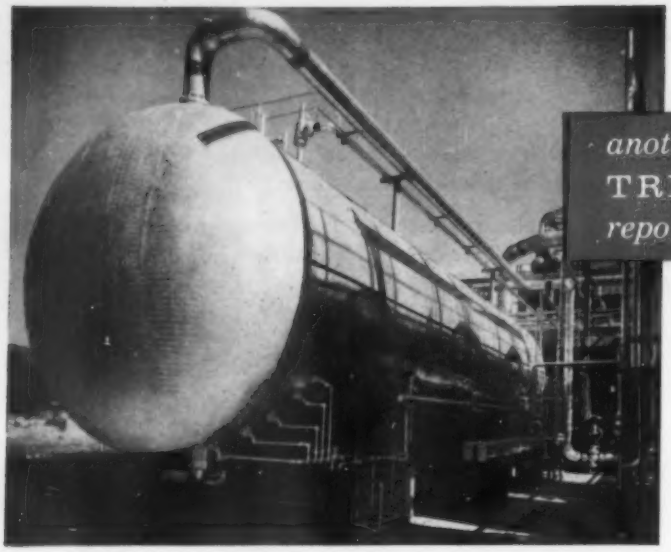


Your choice of receivers

Recording receiver
Indicating retransmitting receiver
ElectroniK recording receiver

Receiver features:

- Indication and/or recording
- Electric or pneumatic control
- Integration
- Auxiliary contacts
- Remote set controller index transmitter
- Up to three pens in one circular chart receiver



another
TRETOLITE SERVICE
report

OVER 1½ MILLION BARRELS OF CRUDE OIL ARE DESALTED EVERY DAY BY TRETOLITE DESALTERS

...average cost: $.0013 per barrel!

TRET-O-LITE* Chemical Desalters are in use in refineries throughout the world, reducing salt contents in the 95% to 100% range, at an average chemical cost of about 1.3 mills per barrel.

HOW TRET-O-LITE CHEMICAL DESALTING WORKS

TRET-O-LITE destabilizer is proportioned into the suction line of the crude charge pump to assure complete dispersion. Washwater (5% by volume of crude charge) is injected immediately following the charge pump. The oil, chemical and washwater mixture is raised to operating temperature, passed through an emulsifying valve, and then through a coalescing section to promote particle growth. The mixture then enters the desalting vessel which provides additional water-washing and settling time. The salt-free crude flows to the still and the saline effluent to the sewer.

*TRET-O-LITE *is a registered trade-mark of Petrolite Corporation*

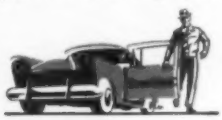
4 CHOICES AVAILABLE

TRET-O-LITE Desalting is available to refiners through four different acquisition options:

1. **STANDARD PROPOSAL**—Construction by refiner according to plans and specifications furnished by Tretolite Company.
2. **STANDARD PROPOSAL WITH GUARANTEE**—As per standard proposal, but with desalting performance guaranteed. Engineering fee is charged when performance is guaranteed and acceptance tests are conducted.
3. **PURCHASE**—Tretolite Company delivers all desalting plant equipment for erection by refiner or his contractor.
4. **RENTAL, WITH OPTION TO PURCHASE**—Equipment furnished by Tretolite Company for erection by refiner or his contractor. Payment by predetermined annual rental fee.

With all of above plans, Tretolite engineers inspect during construction and supervise start-up and acceptance tests.

For complete information
ask the Man in the Red Car.
Or write to...



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PETROLITE CORPORATION

TRETOLITE COMPANY
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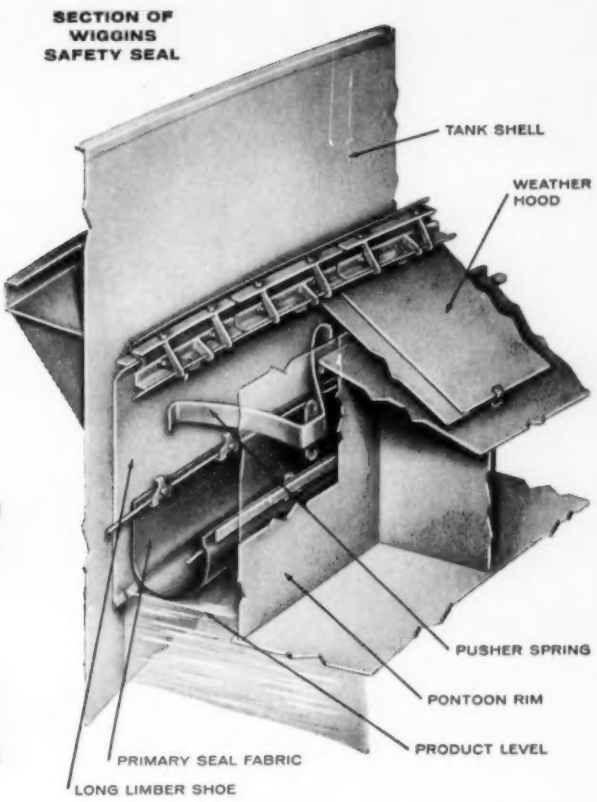

GIVES YOU MAXIMUM PROTECTION AGAINST FIRE, PRODUCT LOSS AND COSTLY MAINTENANCE

Look at these 9 points of superiority:

1. *Safety Seal* exclusive design eliminates critical vapor spaces, does away with rim fires.
2. *Safety Seal* eliminates losses from thermal breathing.
3. No metal working parts ever touch the liquid.
4. Weather hood protects *Safety Seal* fabric from the elements.
5. *Safety Seal* makes tanks safe for highly volatile, highly flammable liquids.
6. Air-vapor volume less than 10% of conventional seals.
7. *Safety Seal* is specially compounded to resist deterioration . . . much longer life than ordinary seals assured.
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9. *Safety Seal* is easy to inspect, easy to maintain.

A Floating Roof is only as good as its Seal.

Wiggins Floating Roofs are in a class by themselves . . . pay for themselves with the savings they provide.

Call the nearest General American office, or write. You'll find that here, as in so many fields, *it pays to plan with General American.*

Plate and Welding Division

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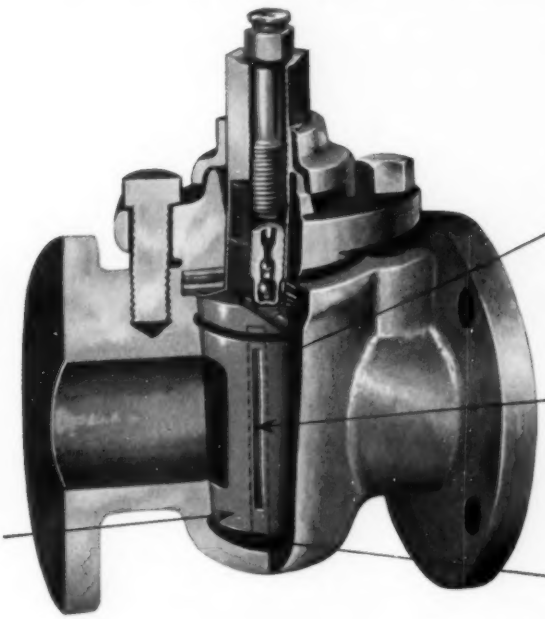
ROCKWELL-Nordstrom **VALVES**

Just a little leak?

Little leaks . . . unless they're stopped . . . sink big ships. And valves with little leaks cost industry millions of dollars every year. In terms of dollars and cents and human lives, there's no such thing as a "little leak."

Valves that leak "just a little" mean ever-increasing product loss, product contamination, or hazards. That's why wherever the safety, precision or economy of flow control dictates that even little leaks can't be tolerated, you'll see Rockwell-Nordstrom lubricated plug valves.

LUBRICANT-SEALED FOR POSITIVE SHUT-OFF


Seats never exposed to line . . . permanent, positive shut-off.
Pressurized lubricant in Seald-port® grooves forms impenetrable seals against leakage . . . lubricant is instantly replaceable seat that can't "wear out."
Solid tapered plug is rugged and self-seating.
Pressurized lubricant hydraulically cushions plug for instant, quarter-turn closure.

Rockwell-Nordstrom is the original and world's most complete line of lubricated plug valves with sizes from ¾" to 36" and pressures to 15,000 lb. Available at leading oil field and industrial supply houses everywhere. For details, see your supplier or write: Rockwell Manufacturing Company, Pittsburgh 8, Pa. If you live outside the U. S. A., write: Rockwell International Division, Pittsburgh 8, Pa.

ROCKWELL-Nordstrom VALVES

another fine product by

ROCKWELL

®Reg. T.M. Rockwell Manufacturing Company

Pinned down by a pinhole!

Sounds ridiculous, but it's true. First sign of trouble at this petroleum refinery was a tiny pinhole caused by corrosion. Further investigation revealed the ruinous effect of corrosion on fractionating towers, reactors, heat exchangers and other costly equipment. Prolonged shut down and expensive repairs resulted.

The cause of this near disaster? Trying to process sour, acid-laden crude oil without making proper provisions in equipment and procedure.

Today, with the help of Universal's service, this and any other kind of crude oil can be handled safely by any refiner. Over a period of more than forty years UOP has accumulated an extensive library of technical data on crudes from wells throughout the world. Through UOP, techniques for handling these crudes and the necessary processes, catalysts, inhibitors, additives and specialized engineering services are available to petroleum refiners everywhere.

Research is where you find it. And Universal has found it in its experiences with refiners throughout the Free World.

UOP®

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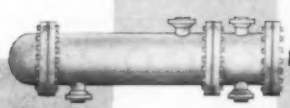
More Than Forty Years Of Leadership In Petroleum Refining Technology

SERVICE: aromatics to aspirin

Benzene and Toluene currently produced at Cosden Petroleum Corporation's Big Spring, Texas refinery, so greatly exceed the purity requirements of the ASTM "Nitration Grade" specifications, that these products are now being used directly in the manufacture of pharmaceuticals such as aspirin and cortisone.

As integral parts of the UOP Rexforming® and Udex® units at Big Spring, Western heat exchangers perform an important service in the conservation and transfer of heat during the selective extraction of these aromatic hydrocarbons.

Heat Transfer requirements for petrochemical processes present a worthwhile challenge, and Western will continue to expand its sphere of influence in the petroleum industry's growing importance to chemical consumers.

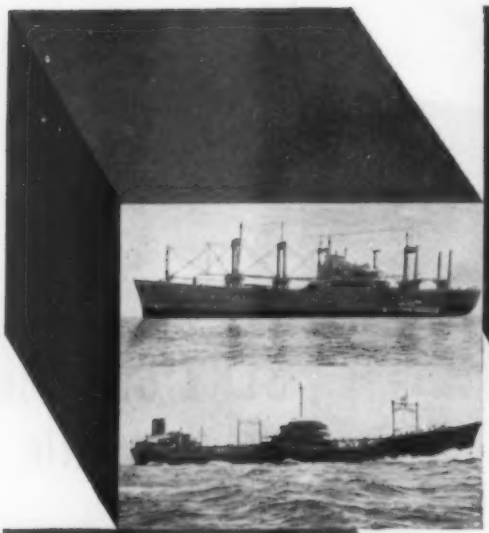


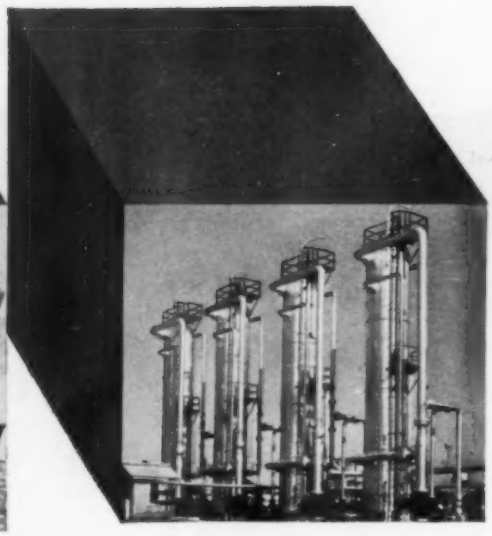
WESTERN

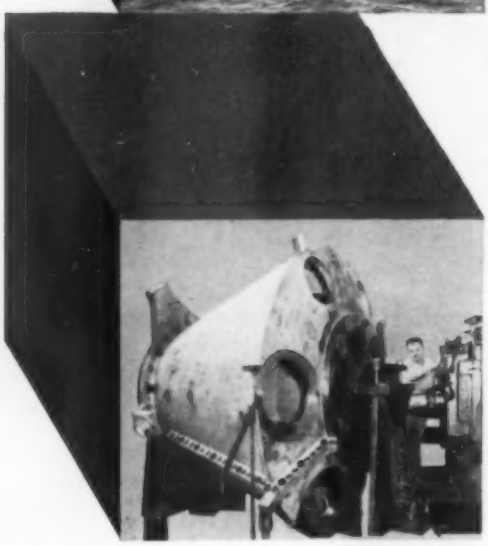
HEAT EXCHANGERS

WESTERN SUPPLY COMPANY

P. O. Box 1888 – Tulsa, Oklahoma







MASTER BUILDERS FOR LAND AND SEA

For more than forty years, engineering leaders in the oil-refining and chemical industries have been calling upon Sun Ship for important components for the building of large plants.

- Manufacturing and fabricating skill that has kept pace with the growth of their great industries . . . and understanding of their problems.
- Facilities and craft skills that can produce . . . and deliver . . . the equipment needed—swiftly.
- A special . . . separate . . . Alloy Products Shop equipped to produce medium and heavy stainless alloy and aluminum products for industry.

BUILDING FOR LAND — Pressure Vessels • Fractionating Towers • Stills and Tanks • Condensers and similar equipment • Special Machinery • Plate Work, etc.

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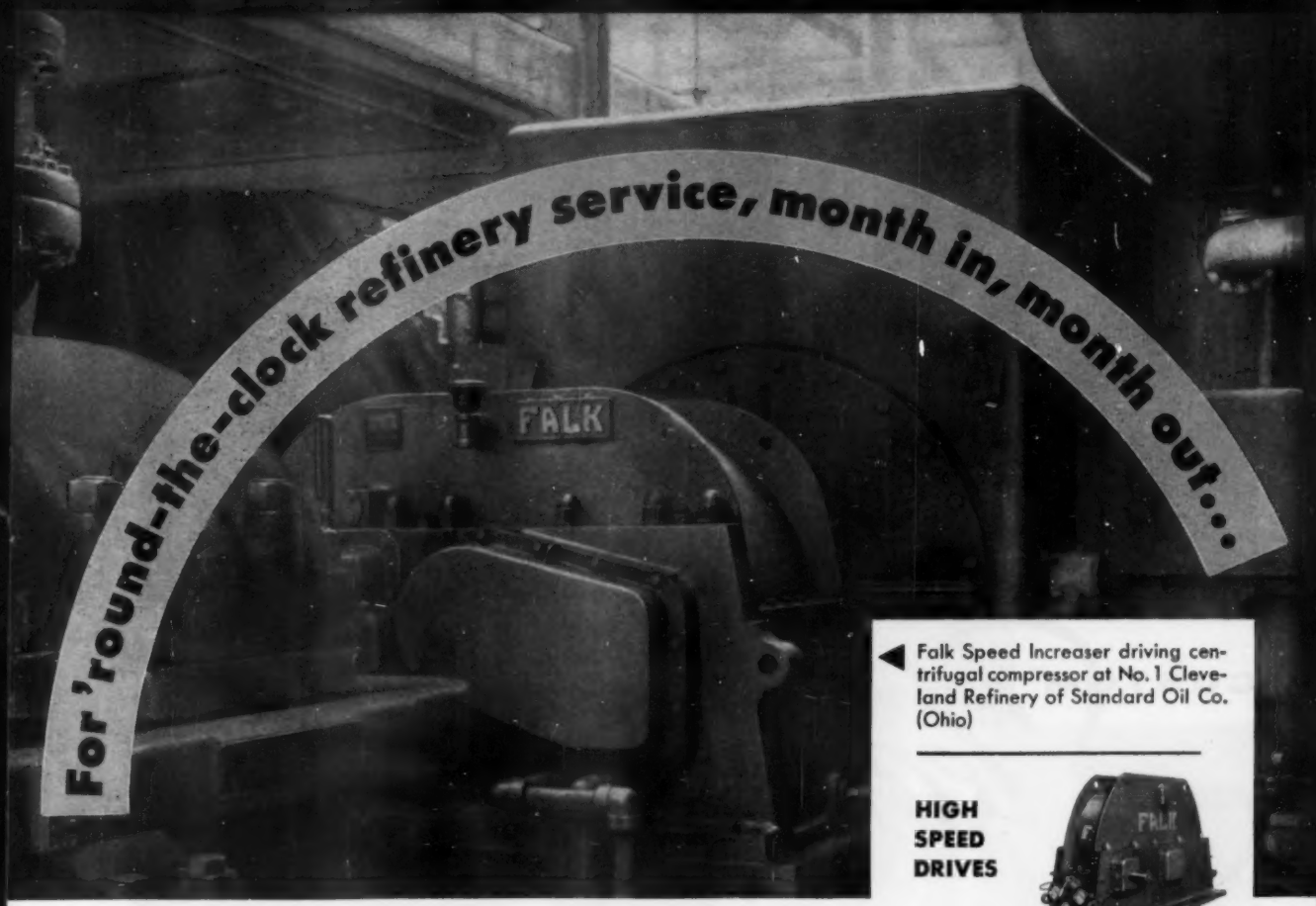

◀ Falk Speed Increaser driving centrifugal compressor at No. 1 Cleveland Refinery of Standard Oil Co. (Ohio)

FALK offers a complete line of standard high speed and semi-high speed drives

type P Ratios—from 2.5:1 to 12.0:1.
Horsepower—up to 2000 hp per 1000 rpm of high speed shaft.
Maximum speed of high speed shaft: 10,000 rpm.

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Maximum speed of high speed shaft: 10,000 rpm.

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Horsepower: up to 1100 hp.
Maximum speed of high speed shaft: up to 3600 rpm.

type S Ratios—from 1.49:1 to 25.4:1.
Horsepower—up to 224 hp.
Maximum speed of high speed shaft: 4500 rpm.

SPECIAL DRIVES...to any required speed and horsepower.

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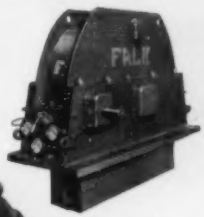
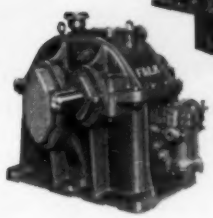
Designed and produced by the Falk engineers who pioneered the ultra-high speed gear units for aviation turbo engine test facilities, Falk standard high speed drives are widely used in refineries throughout the country. Our technicians will be glad to work with your engineers or with your equipment suppliers to select and produce drives precisely suited to your operation.

FALK is a Registered Trade Mark.

HIGH SPEED DRIVES

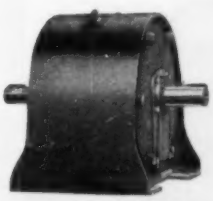




type P

type Q

SEMI HIGH SPEED DRIVES



type H

type S

THE FALK CORPORATION, MILWAUKEE 1, WISCONSIN

MANUFACTURERS OF QUALITY GEAR DRIVES AND FLEXIBLE SHAFT COUPLINGS

Representatives in Most Principal Cities

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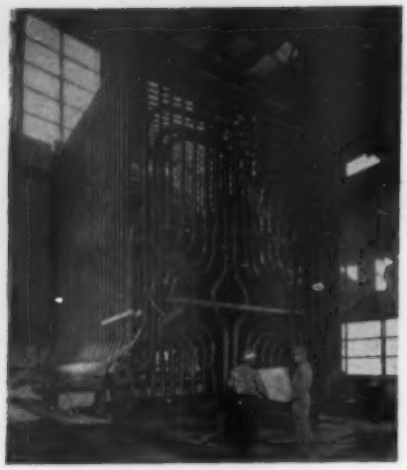
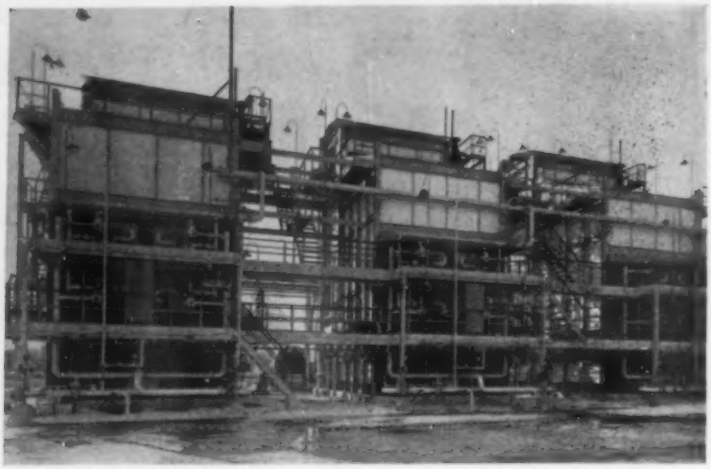
...a good name in industry





AT LEFT: Installing a 60,000 lbs/hr unit in a brewery

ABOVE: A battery of 125,000 lbs/hr units in a chemical plant

CUSTOM *Steam* GENERATORS by Vogt

Vogt engineering advances can save you money if you have a steam generating problem. Custom-built installations shown, are engineered to assure efficient, dependable steam generation for power, process and heating. Our engineering staff is available to give effective help in the solution of steam generating problems peculiar to a wide variety of operating conditions. Address Dept. 24A-BO.

HENRY VOGT MACHINE CO.
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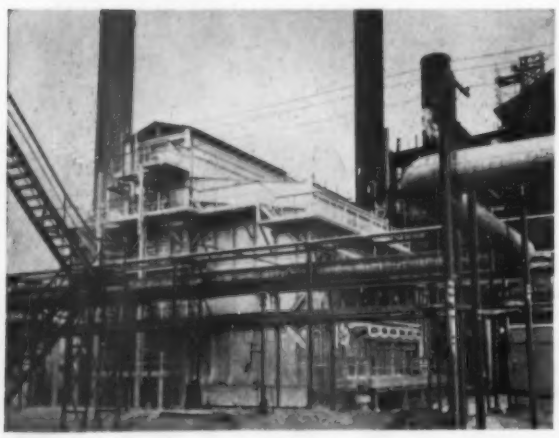
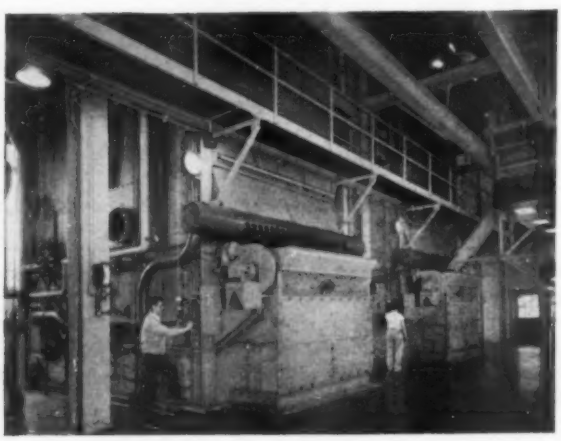


This 400,000 lbs/hr unit is installed in a leading petroleum refinery



Three 40,000 lbs/hr units serve a medical center

Stauffer

adds a third

Anhydrous

HCl plant

at

Fort Worth

HCl

This will increase the country's supply of high-purity Anhydrous Hydrochloric Acid by many tons per day.

Available for Immediate Delivery: 57-pound net cylinders, Tube Trailers.

Stauffer also supplies Anhydrous Hydrochloric Acid from plants at Los Angeles and Louisville, Ky.; aqueous HCl from San Francisco, Baton Rouge, La., Henderson, Nev., No. Portland, Ore., Houston, Tex., & Tacoma, Wash.

Send for new 44-page brochure.

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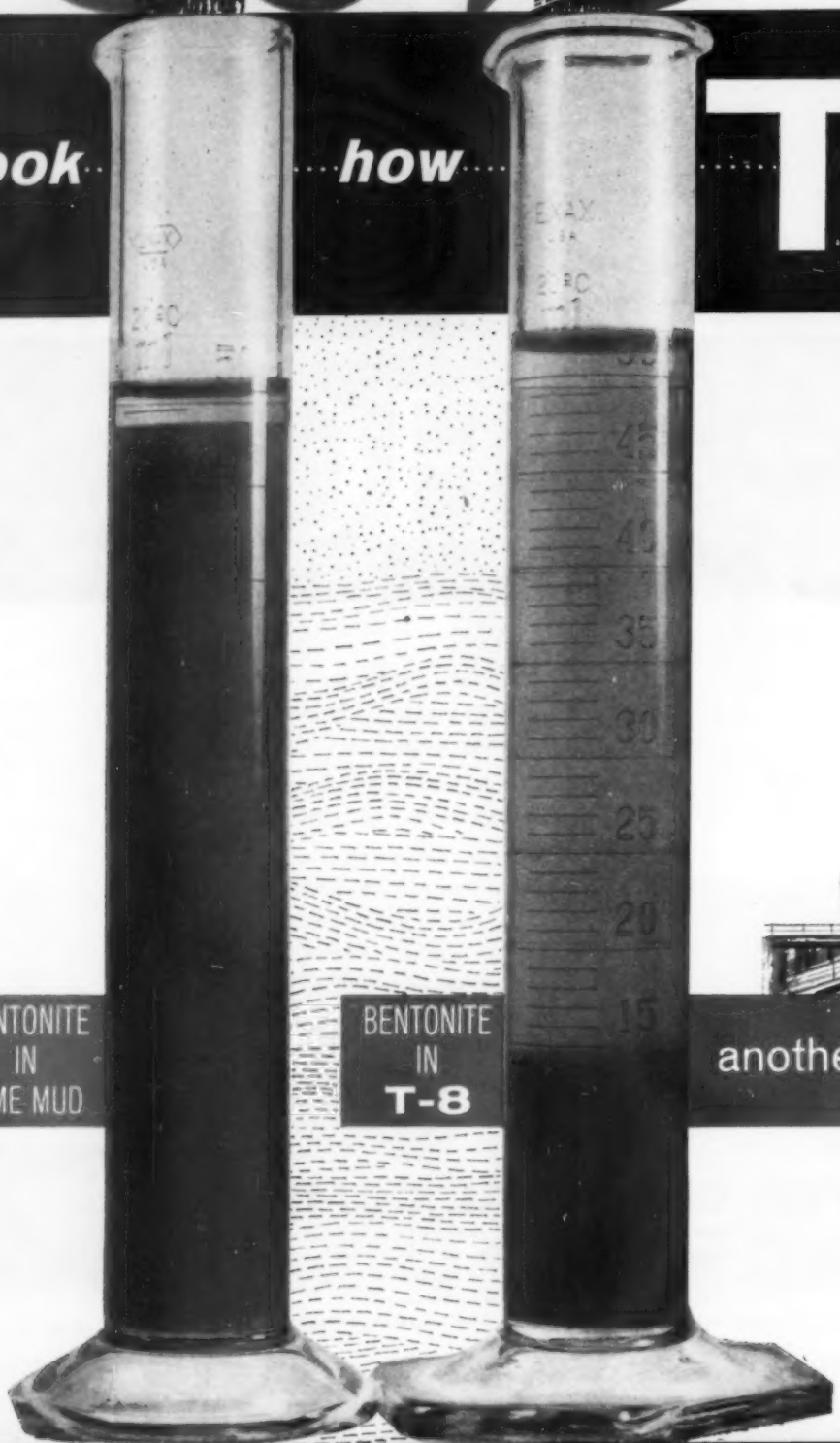
Stauffer CHEMICALS SINCE 1885

well a,b well

Look how T-8



BENTONITE IN LIME MUD

BENTONITE IN **T-8**

another *well done*

....and Magcobar engineering cut mud cost on well

NEW ORLEANS AREA

	depth	type mud	weight mud	cost of mud
a	13,600 ft.	Lime	15.6 lb./gal.	$130,000
b	13,590 ft.	T-8	15.6 lb./gal.	$ 65,000

All along the Gulf Coast, savings have been substantial using T-8 instead of other muds in drilling shale formations. The secret of T-8, as the graduates to the left show, is that it reduces the hydration and dispersion of solids, minimizing the build-up of formation solids in the mud system.

With other muds, shale solids become part of the drilling fluid, increasing the viscosity. Water, added to reduce viscosity, lowers the mud weight, and new barite must be added. The additional barite and water increase the volume, so that expensive mud is jetted. With T-8 you can maintain good mud properties with less jetting, less barite, and at impressive savings.

The successful field performance of T-8 confirms Magcobar's basic approach to drilling fluid problems: Developing better products to solve specific drilling problems, and training better mud engineers to insure the highest level of performance from these products.

T-8 is only one of Magcobar's many answers to the problem of high drilling costs. The right products *used right* by Magcobar can cut costs on your next well, too.

Wherever your drilling operations, you can use Magcobar engineering and products. There are more than 500 stockpoints in the U.S. and Canada. Elsewhere, write Foreign Operations, P. O. Box 6504, Houston, Texas.

with Magcobar Technology

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Magcobar
Complete
DRILLING MUD SERVICE

extend high pressure systems *without* interrupting service!

use **MUELLER**®

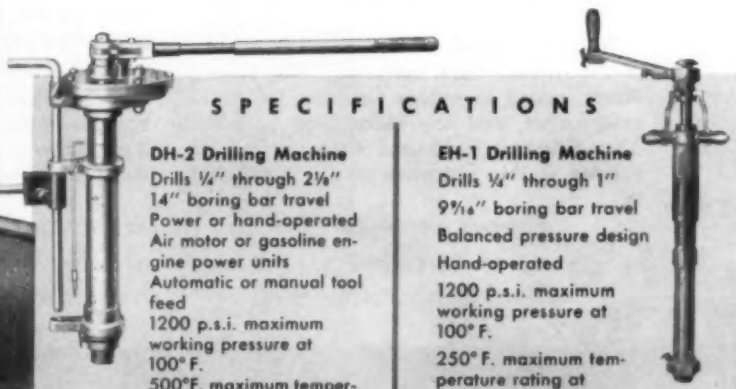
DH-2 or EH-1 drilling machines

Just a few simple steps are all that is needed to add a line to your high pressure air, steam, water, gas, crude or refined oil or chemical piping systems when you use the Mueller DH-2 or EH-1 Drilling Machine.

Lateral lines are added quickly and safely under completely controlled conditions. Service to other parts of your plant or refinery are not interrupted while the tie-in is being made.

At left is shown the power-operated DH-2 Machine attached to a Mueller Curb Valve Tee and drilling into a high pressure line. A variety of Mueller No-Blo Fittings are available for use with either the "DH-2" or "EH-1" machines.

Write for complete information.



SPECIFICATIONS

DH-2 Drilling Machine

Drills ¼" through 2⅛"
14" boring bar travel
Power or hand-operated
Air motor or gasoline engine power units
Automatic or manual tool feed
1200 p.s.i. maximum working pressure at 100° F.
500°F. maximum temperature rating at 1,000 p.s.i.

EH-1 Drilling Machine

Drills ¼" through 1"
9⁹⁄₁₆" boring bar travel
Balanced pressure design
Hand-operated
1200 p.s.i. maximum working pressure at 100° F.
250° F. maximum temperature rating at 1140 p.s.i.

NO-BLO®

MUELLER CO. since 1857 SERVING the Water and Gas Industries QUALITY

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DECATUR, ILL.

Factories at: Decatur, Chattanooga, Los Angeles; In Canada: Mueller, Limited, Sarnia, Ontario

Engineering Progress Report
FROM UNION CARBIDE CHEMICALS COMPANY

Prewashing of Refinery Gas Stream Reduces Diethanolamine Fouling

Gas sweetening cost reduced by preventing contamination

Most refinery gas treating plants using diethanolamine to remove hydrogen sulfide have operated for years with little trouble. However, there have been some instances where the solution has rapidly become fouled.

Laboratory analyses and actual field investigations have revealed that the formation of heat-stable salts is frequently a major contributor to solution fouling. Research has further shown that the formation of these salts can often be controlled by prewashing the gas stream. CARBIDE's Technical Service Department has helped achieve maximum operating economy for many ethanolamine users.

THE EXISTENCE OF HEAT-STABLE SALTS

Estimates of diethanolamine losses in treating operations are based on the observation that the solution progressively declines in capacity to accept acid gases. Analytic procedures suggest that the diethanolamine is not being physically lost from the system by leakage, vaporization or entrainment, but is being converted to heat-stable salts. Examination of many used diethanolamine solution samples from customers' plants has confirmed the presence of heat-stable salts of organic acids such as formic and acetic.

$$DEA + HCOOH \longrightarrow DEA \cdot HOOCH$$

$$DEA + CH_3COOH \longrightarrow DEA \cdot HOOCCH_3$$

THE FORMATION OF OTHER SALTS

In some cases, hydrogen cyanide also enters the treating plant in the gas stream and is combined with diethanolamine as a soluble salt in the absorber section, as are carbon dioxide, hydrogen sulfide, and other acidic components. Analyses of used plant solutions has confirmed the presence of ferrocyanides. It appears likely that they are formed by one or both of the following reaction routes.

1. $Fe(HCO_3)_2 + 6\ DEA \cdot HCN \rightleftharpoons 2DEA \cdot HCO_3 + (DEAH)_4Fe(CN)_6$

2. $Fe + 2H_2O \longrightarrow Fe(OH)_2 + H_2$

$$Fe(OH)_2 + 2HCN \longrightarrow Fe(CN)_2 + 2H_2O$$

$$Fe(CN)_2 + 4HCN \longrightarrow H_4Fe(CN)_6$$

$$H_4Fe(CN)_6 + 4DEA \longrightarrow (DEAH)_4Fe(CN)_6$$

PREVENTION OF SALT FORMATION

It is possible to minimize the contamination of amine solutions from organic acids by prewashing the gas stream with an alkali solution or water.

In an alkali prewash, some of the caustic will be converted quickly to sodium acid sulfide and sodium sulfide (or the corresponding carbonate salts) by the hydrogen sulfide (or carbon dioxide) in the gas. Nevertheless, the solution will still remove formic and acetic acids since these stronger acids will replace the weaker sulfides and carbonates.

Caustic solutions may not be as effective in removing hydrogen cyanide as they are in removing formic and acetic acid from gas streams rich in hydrogen sulfide or carbon dioxide. This is because the sulfides and carbonates replace the weaker cyanides. The high water solubility of hydrogen cyanide (and the relatively low solubilities of hydrogen sulfide and carbon dioxide) makes water washing an alternate method of hydrogen cyanide removal.

Prewashing not only reduces fouling of the diethanolamine but is also beneficial because the contaminants that are removed may sometimes promote corrosion.

FURTHER STUDIES

Union Carbide Chemicals Company is continually engaged in research designed to improve the products and processes of the gas conditioning industry. The results of this research are readily available to the industry from CARBIDE's Technical Service Department. If you would like more information on CARBIDE's Technical Services to the gas treating industry, call our nearest technical representative or write, Union Carbide Chemicals Company, Room 328, Department B, 30 East 42nd Street, New York 17, New York.

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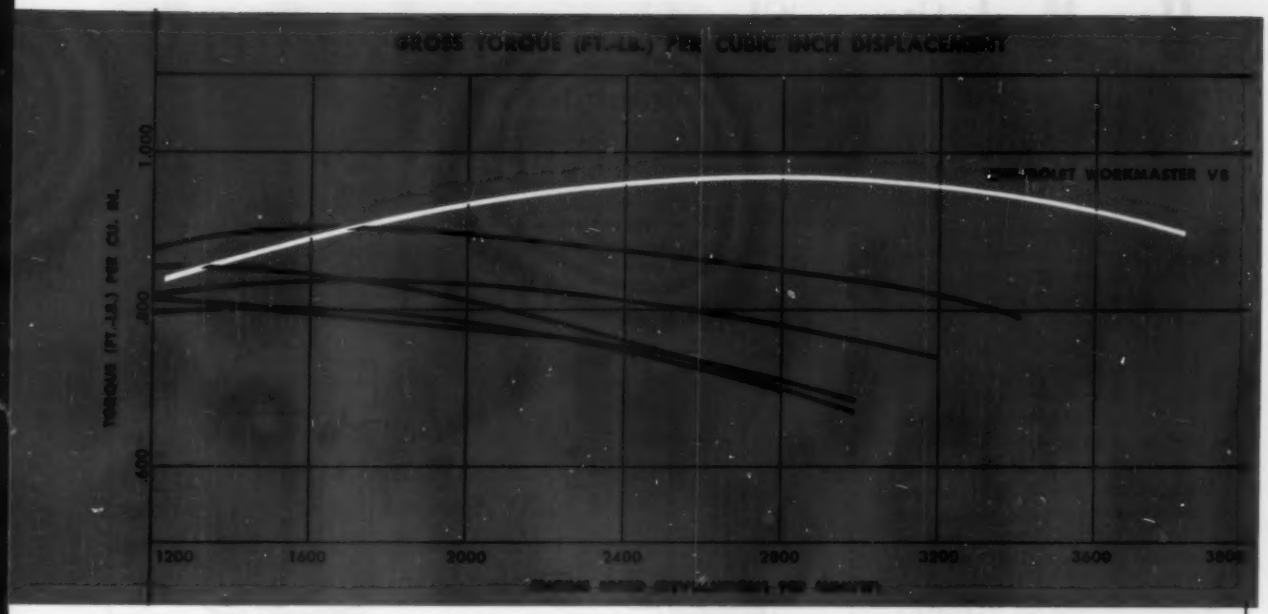
UNION CARBIDE CHEMICALS COMPANY
DIVISION OF
UNION CARBIDE
CORPORATION

It's torque that beats tough jobs, and this engine has it to spare!

CHEVROLET'S 348-CUBIC

It's torque you need in a big-truck engine. Torque that gives the truck plow-horse pulling ability at low speeds . . . torque that assures the power to keep big loads moving, whether it's through the rough or over the road. And Chevrolet's 230-h.p. Workmaster V8, with efficient Wedge-Head design, short piston stroke and the right kind of valve timing, puts out a brand of torque that's made to order for your toughest big-tonnage hauls.

No job's too tough for a



Here's proof that Chevrolet's 348-cubic-inch Workmaster V8 puts out plenty of torque — all the pull and power you'll ever need for your high-tonnage hauls. The white curve above shows that the Workmaster provides high torque throughout the *entire range* of operating speeds; that it puts out high torque at low r.p.m.'s where you need it for tough off-road situations, maintaining high torque right up to governed speed. The black curves on the above graph represent the torque output of typical heavy-duty 6-cylinder engines of between 330 and 390 cubic inches of displacement. (Each of the above curves demonstrates actual torque output efficiency, on a basis of gross foot-pounds of torque per cubic inch of displacement.)

-INCH WORKMASTER V8

Among today's big-truck V8's, Chevrolet's 348-cubic-inch Workmaster is outstanding for its ability to produce extra foot-pounds of work-whipping torque. This high torque output is the natural result of the Workmaster's unique design characteristics. Short piston stroke and large piston area, for example, comprise a torque-producing advantage, and *this engine provides the shortest stroke in its class.*

Advanced Wedge-Head design, with its fully machined combustion chambers, means high torque, too. It assures high turbulence of the fuel-air mixture and balanced power output from each cylinder. The Workmaster V8 has high volumetric efficiency . . . takes in the fuel-air mixture *efficiently* at all speeds. This, combined with a camshaft design that gives just the right valve lift and timing, assures high torque — extra pulling power to get you through the tough spots!

And this engine is designed for *durability* as well. Tough Moraine-400 bearings, for instance, last up to 7 times longer than ordinary bearings. Stellite-faced, high alloy exhaust valves resist wear. Tough induction-hardened crankshaft journals last longer . . . Rotocoil exhaust valve rotators increase valve life by as much as 300%.

For these reasons and many more like them, the Workmaster is a solid performer — a sure answer to extra savings on big-tonnage runs. Now *standard equipment* in all Chevrolet Series 90 and 100 trucks, it powers G.V.W.'s up to 25,000 lbs. and G.C.W.'s up to 48,000 lbs. . . . or, in Series 100 tandem models, G.V.W.'s up to 36,000 lbs., G.C.W.'s up to 50,000 lbs. For the kind of torque and toughness you need to do big jobs better, see your Chevrolet dealer about a Workmaster V8! . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

Chevrolet Truck!

CHEVROLET

How Much Steam Should a Steam Trap Trap?

. . . some answers to commonly asked questions about the primary job of a steam trap

You don't need a doctor's degree in thermodynamics to answer the question at the top of this page. Naturally, a steam trap should trap *all* the steam.

Unfortunately for you, the problem isn't quite that simple. After all, a shut off valve would trap all the steam . . . and condensate, and air, and carbon dioxide as well.

So we'd better amend the answer to the question this way: A steam trap should trap *all* the steam but *must* remove condensate, air and carbon dioxide as rapidly as they accumulate.

With this established, let's take a closer look at what's involved:

A Steam Trap Should Trap All The Steam

If you've had experience with several different makes of traps, you already know that some trap steam better than others. The operating principle of the trap is what makes the difference. We like to talk about it because Armstrong traps are designed so that no steam can get to the orifice. The valve is always water sealed. Result: *More efficient steam utilization, lower fuel costs.*

A Steam Trap Should Remove Condensate

All traps remove condensate—after a fashion. For maximum efficiency in the unit being drained, though, the trick is to get it out without waiting for it to cool and without leaking steam.

Armstrong's water sealed valve takes care of steam leakage. The inverted bucket operating principle opens the trap for water regardless of its temperature. This means you get the condensate out as quickly as it accumulates. Result: *Higher temperatures and better heat transfer in steam heated units.*

A Steam Trap Should Remove Air and CO_2

Part and parcel of the condensate removal problem is removal of air as well as oxygen and carbon dioxide—two real troublemakers. Air tends to reduce operating temperatures and interfere with heat transfer. CO_2 goes into solution to form corrosive carbonic acid which, for example, can eat unit heater tubes. O_2 aggravates the situation. Believe it or not, but all traps don't properly remove air and CO_2.

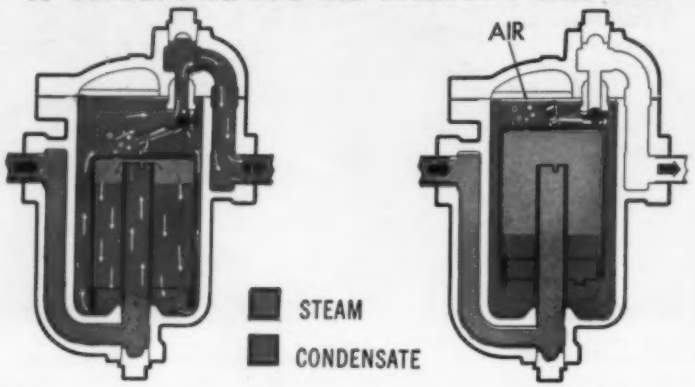
By now, you've probably guessed that Armstrong traps *do* remove air and CO_2. Armstrong design (see illustration) provides continuous venting of air and CO_2. By opening suddenly, the Armstrong trap creates a momentary pressure drop to "pump" the air down to be vented. Result: *Higher temperatures, faster heat-up, better heat transfer and reduced corrosion.*

Note: When required, specially sized air vents are furnished. For fast heat-up of low pressure on-and-off units, Armstrong provides open float and thermostatic air vent traps.

What's the Final Answer?

Summing it all up, you'll get the best service from steam heated units that are equipped with traps designed to trap *all* the steam and remove air and condensate as quickly as it accumulates. In our prejudiced viewpoint, this means Armstrong traps. More important are the several thousand users of Armstrong traps who have proved the point.

HERE'S THE STEAM TRAP DESIGN THAT GETS RID OF CONDENSATE AND AIR WITHOUT STEAM LOSS



Trap open. Condensate entering trap has caused bucket to lose buoyancy. Weight of bucket times leverage pulls valve open. Air is discharged along with condensate.

Trap closed. Steam has floated inverted bucket; valve is held tightly closed by system pressure. Air entering trap passes through bucket vent and accumulates at top of trap.

Before you make up your mind, though, consider the minimum maintenance requirements of Armstrong traps . . . and the convenient assistance your local Armstrong Representative provides. These are important plus values.

Put Up or Shut Up

We're so confident that we "put up". Armstrong traps are unconditionally guaranteed to satisfy. So you can find out for yourself with practically no risk. If you're not completely satisfied with the way they do their job, you can get your money back.

* * *

The 44-page Armstrong Steam Trap book goes into greater detail on these and other Armstrong features. It also discusses trap selection, installation and maintenance. Ask your Armstrong Representative for a copy or write

Armstrong Machine Works
8681 Maple Street
Three Rivers, Michigan

ARMSTRONG STEAM TRAPS

HAMONDFLOTE* plastic COVER CRASHES CONSERVATION BARRIER

For over one year Sohio has tested a HAMONDFLOTE COVER installation at their Andover, Ohio bulk station. Tests involved mechanical operation, general performance and conservation characteristics.

Based on the results of tests SOHIO HAS PURCHASED SIXTEEN ADDITIONAL HAMONDFLOTE COVERS for their field conservation program.

. . . And here's what the man in charge of Sohio's station says:

"In reply to your letter of January 12, I have a HAMONDFLOTE COVER in an upright gasoline tank containing two four inch inside circumferential angles. The COVER is working excellently. It floats up and down over the angles with no ill effects on the COVER. I cannot see that there has been any wear on the COVER in a years use. It is a 25,000 gallon tank and I sell 10,000 gallons a week so it has had constant use.

The savings were apparent a week after it was installed as no fumes could be detected by nose through the top manhole cover.

It has not caused any trouble as far as filling or measuring the product or overall depth of tank (as for water or contamination of product) since it was installed. I would highly recommend the HAMONDFLOTE COVER for all products, especially gasolines." 9

Robert Runyan,

The Hamondflote Cover is the first practical, economical and guaranteed floating roof for small diameter tanks in marketing, bulk storage, producing and processing operations . . . constructed of rigid Polyisocyanate foam—a plastic material with exceptionally low density and high load carrying capacity, chemically inert to hydrocarbons. The Hamondflote Cover: Pays for itself in several months • Prevents product evaporation • Conserves vapor • Preserves product • Reduces corrosion of storage tanks • Low cost—no maintenance • Unsinkable • Virtually indestructible • Long life *(more than 10 years expectancy)* • Unaffected by working temperatures *(from —94° to + 300° F* • Easily installed or removed

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*Pat. Pending, Trade Mark reg.

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Gentlemen:

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☐ Please send us a copy of "Stop Evaporation" or have your representative call.

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Address_____

IT'S NEWS! IT'S NI-O-NEL!

...a field-proven Inco Nickel Alloy for handling certain hot acids and oxidizing chemicals

Inco is now making available a field-proven alloy to handle corrosive conditions of unusual severity.

The alloy, called Ni-o-nel*, is made of Nickel (42%), chromium (21.5%), and iron (30%) with additions of molybdenum and copper. It is highly resistant to hot sulfuric, sulfurous and phosphoric acid conditions and to oxidizing conditions such as nitric acid solutions, nitrates and cupric, ferric and mercuric salts, except the chlorides.

Ni-o-nel alloy is stabilized by the addition of titanium and by its moderately low carbon content to prevent attack due to carbide precipitation.

In phosphoric acid:

1. Ni-o-nel alloy submerged cylinders and baffle plates in submerged combustion evaporators concentrating wet process phosphoric acid at temperatures up to 280°F, are giving 3 to 5 times the service life of previously-used materials.

2. In the dip pipes of units concentrating phosphoric acid by passing preheated air into the acid, Ni-o-nel alloy outlasted the previous alloy by 11 to 7.

3. In a defluorinating unit handling phosphoric acid of 54% P_2O_5 content, Ni-o-nel alloy lasted 2 to 6 times longer than the best previously-used alloy.

4. Ni-o-nel alloy can also be used in many similar applications such as hydrocarbon polymerization processes using phosphoric acid as catalyst, and for heating coils in the application of phosphate coatings to steel.

In sulfuric acid:

1. Platecoils of Ni-o-nel alloy have been used for heating a 12% (by wt.) sulfuric acid pickling bath maintained at 170°F. The platecoils lasted approximately 3 years (6 times longer than those of another resistant alloy).

2. Ni-o-nel alloy dancer roll arms in a continuous pickler used for processing steel strip in 8-12% sulfuric acid at 130°F temperature have so far lasted 17 months – 3 times longer than the previously-used alloy, and are still going strong. The Ni-o-nel alloy parts are subjected to considerable aeration as well as to the pickling solution itself.

In other corrosives:

1. Sulfurous acid. Ni-o-nel alloy has been shown to be superior to alloys customarily used to handle sulfurous acid in pulp and paper applications and in handling sulfurous combustion gases.

2. Nitric acid mixtures. Ni-o-nel alloy is resistant to nitric acid solutions of practically all temperatures and concentrations and shows good promise for handling such mixtures as nitric-sulfuric, nitric-phosphoric and some nitric-hydrofluoric acid solutions.

3. Organic acids. The alloy is resistant to most organic acids and has excellent resistance to boiling concentrated acetic acid, acetic-formic mixtures, maleic and phthalic acid and a number of others.

4. Sea water and chlorides. This alloy not only resists a wide range of chemical corrosives but also certain troublesome salt cooling waters, making it particularly adaptable for heat exchanger equipment. It resists pitting in salt water and has excellent resistance to stress-corrosion cracking.

*Registered trademark

Ni-o-nel alloy is a fully developed engineering material

Ni-o-nel alloy is made in all mill forms needed for fabricating process equipment... including welding electrodes. To get detailed information on this new engineering material, write for Inco's booklet, "Introduction to Ni-o-nel."

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  Prevents gum formation and stabilizes tetraethyl lead.
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  acts as catalyst in air-oxidation of mercaptans.
- ***Completely Non-Toxic***
  non-irritating to the skin, requires no special handling precautions.

A completely new gasoline additive! As an antioxidant, UOP 88 is high in potency and uniform in quality. Too, it is the lowest-cost phenylenediamine type antioxidant on the market. UOP 88 will also fill your need as an air-sweetener for catalytically cracked naphthas. Non-toxic and non-irritating to the skin, it is a 100% active ingredient and remains liquid at all ambient temperatures.

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30 Algonquin Road, Des Plaines, Illinois, U.S.A.

LimiTorque VALVE CONTROLS

...operate 8" GROVE THRU-CONDUIT VALVES ON MANIFOLD, in products pipe line of a large natural gas company

The LimiTorque Valve Operators shown above are of the *Integral Control Type* (another first by LimiTorque) . . . These self-contained "packaged units" offer integral mounted NEMA rated reversing controllers, push-button and indicating light elements . . . The push-button elements, selector switches, etc. are mounted inside the hinged cover for quick, easy accessibility.

LimiTorque "Integral Control" Operators can save up to 50% over separate component equipment and installation costs—and, they are simple, foolproof and absolutely dependable. Send for LimiTorque Bulletin 10-A-58, which completely describes and illustrates these new and exclusive Valve Operators.

LimiTorque is the most widely used automatic valve operator—thousands are operating day and night on Pipe Lines and in Refineries throughout the world. The wide preference for LimiTorque stems from previous performance under all service and climatic conditions: heat, cold, dust, fumes, sleet, snow and rain.

There is no guess work or labor connected with LimiTorque Valve Controls—one key man can open and close any type of valve, quickly and dependably in remote or hazardous locations; thus pipe line and refinery operation procedure can be handled easily and safely.

LimiTorque may be actuated by any reliable power source, such as Electricity, Oil, Gas, Water or Air.

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The Bourdon tube in Ashcroft Duragauges is machined mirror-smooth inside and finish ground outside to exact tolerances. Strong, uniformly thick walls assure precise flexibility–sustained high accuracy and long life.

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Order your Ashcroft Duragauges with the best Bourdon tube material for your service. Choose the all-stainless-steel movement or stainless steel with nylon bearings and pinion gear. Full range of pressures, dial sizes, case designs and materials available. In any combination of components, Duragauges give sustained high accuracy and long service. Get details from your industrial supply distributor.

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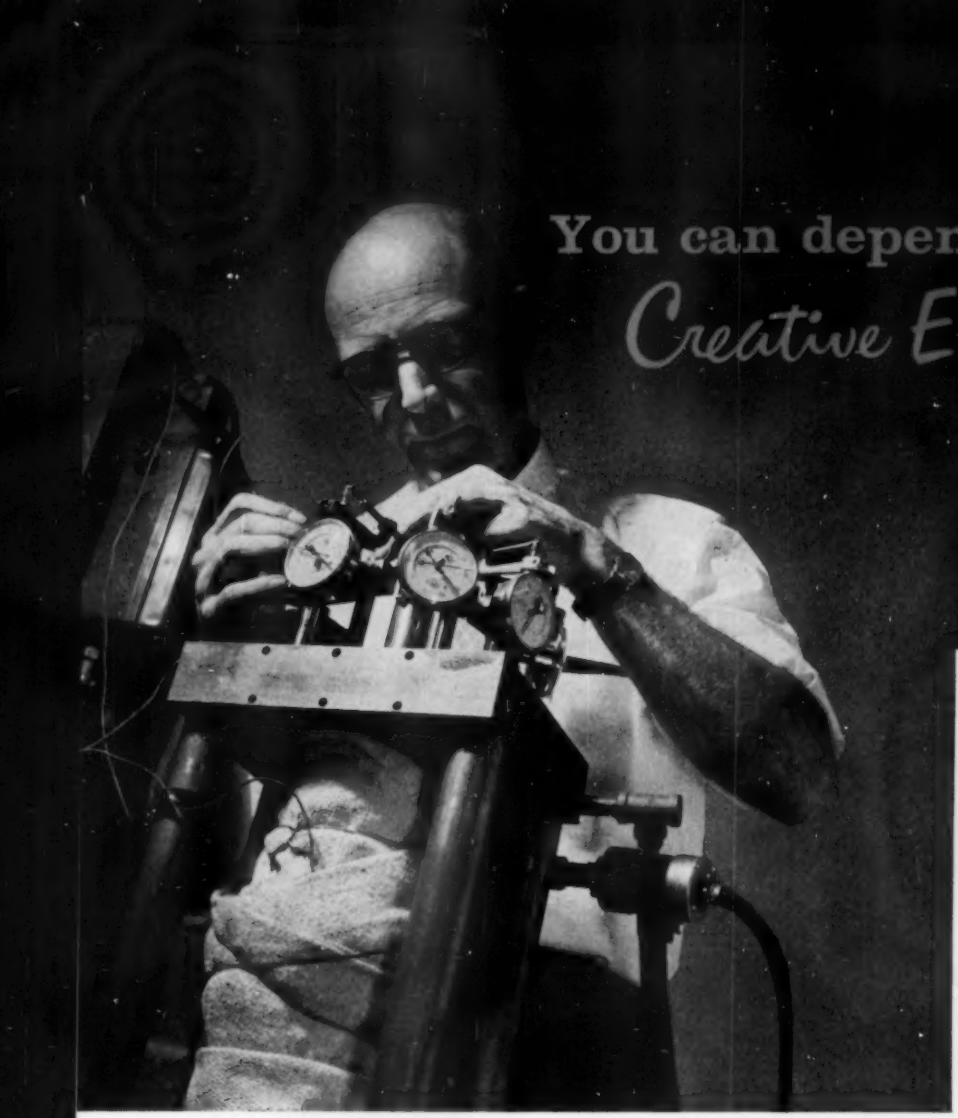

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W-K-M's leadership in its special fields results from research into your most difficult problems and the development of practical solutions that meet the most exacting demands of performance, easy operation and economy.

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Specify W-K-M with confidence—*you can depend on W-K-M's creative engineering.* For complete information covering W-K-M products, write for the literature indicated at right.

W-K-M Through-Conduit Gate Valves for Oilfield Service
Catalog 200

ACF Lubricated Plug Valves (Semi-Steel)
Catalog 400
(Steel)
Catalog 1100

KEY Refinery Fittings and Return Bends
Bulletin KR-1257

KEY Pipe Joint Compounds
Circulars 239-B and 240-B

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Catalog 1000

KEY-KAST Alloy Welding Fittings
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SAVE with Safe, Automatic Power

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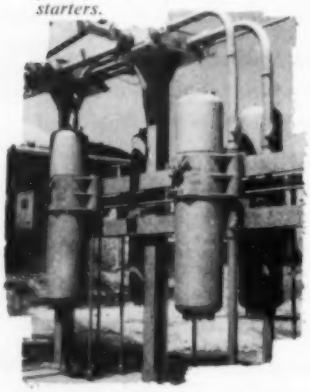

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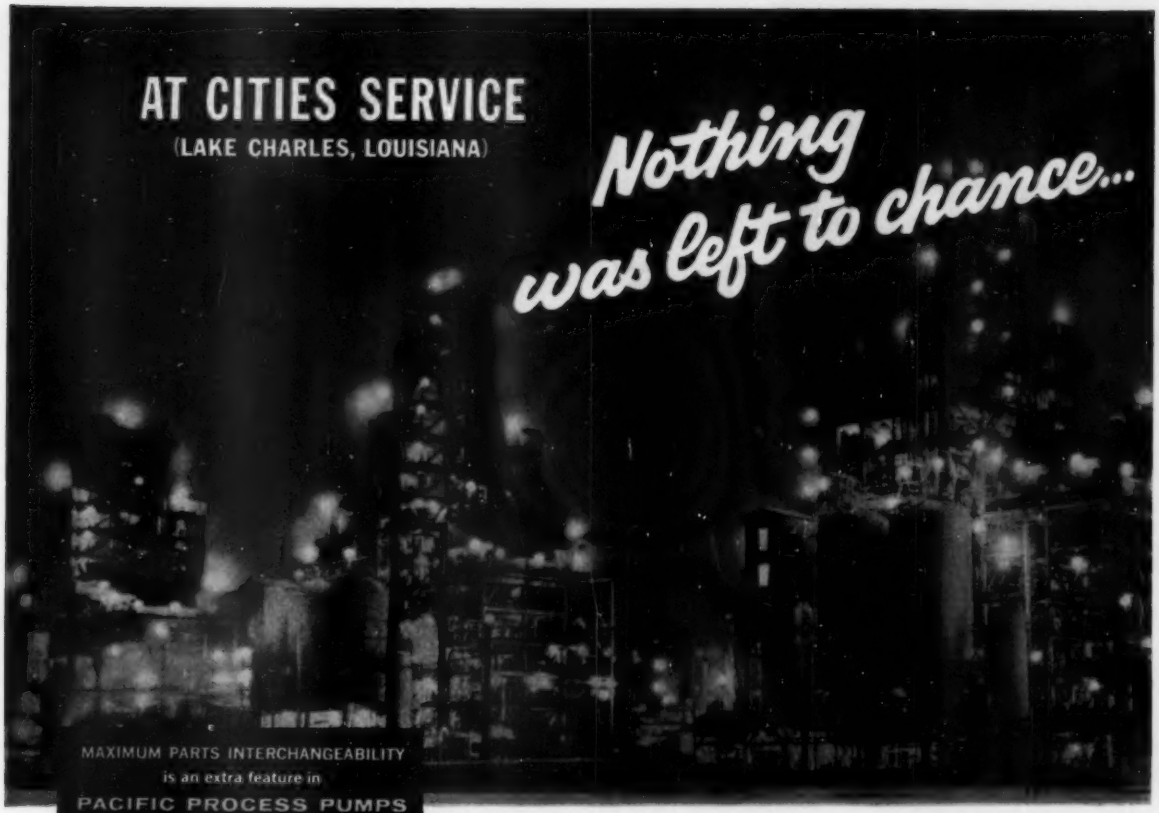

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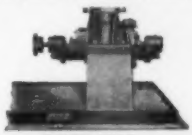
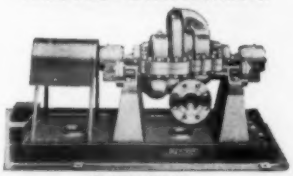
To 850°F.—25 to 3200 GPM
To 600 PSIG—To 650 DIFF. HD. FT.



TYPE HVC
To 850°F.—600 to 4500 GPM
To 600 PSIG—To 1000 DIFF. HD. FT.



TYPE RHC
To 500°F.—50 to 3000 GPM
To 700 PSIG—To 1300 DIFF. HD. FT.

TYPE AC
To 850°F.—100 to 2500 GPM
To 1000 PSIG—To 2600 DIFF. HD. FT.

Practically 100% PACIFIC

process pumps are in service at:

CITIES SERVICE REFINERY
PETRO-CHEMICAL, INC.
CIT-CON, INC.

The three fluid catalytic crackers illustrated have established new records for continuous operation since going on stream. Under the most demanding service conditions, all three units came through remarkably. Number two unit operated for 1058 consecutive 24-hour days only to be outdone by its sister unit with a record of 1065 days continuous operation. We feel that the 100% Pacific installation (including slurry pumps) contributed to making these run-records possible.

Elsewhere throughout Cities Service, P.C.I. and Cit-Con operations, Pacific process pumps are delivering equally dependable 'round-the-clock service...convincing evidence that "nothing was left to chance."

Write for Complete Line Bulletin 1C
plus individual bulletins for pumps illustrated in panel.

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A Division of Dresser Industries, Inc.
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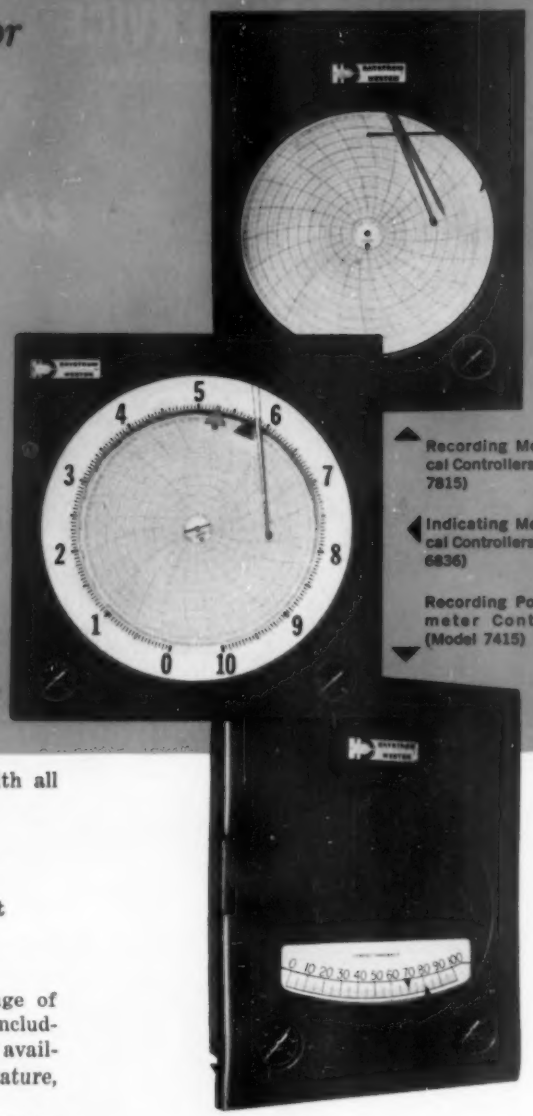
When your process calls for

PRECISE, VERSATILE CONTROL

Choose from the DAYSTROM-WESTON complete family of recording and indicating pneumatic controllers


Recording Mechanical Controllers (Model 7815)
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Each of these advanced instruments is available with all varieties of pneumatic control:

1. Universal: 2-50% proportional band; on-off; and 2-100% differerential gap, manual reset
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The mechanical instruments cover the complete range of filled thermal systems, pressure spirals and bellows, including pneumatic receivers, interchangeably. Ranges are available as low as —100F. and as high as 1000F. for temperature, and 30" vacuum to 10,000 psi for pressure.

The unitized potentiometer instruments feature plug-in amplifiers, easily interchangeable range standards and slide wires. Constant current is supplied by the D-PAK (T.M.)—Daystrom-Weston's revolutionary solid-state unit which eliminates battery, standard cell, and other standardizing mechanisms.

All models come in dust and moisture-resistant cases and are for universal mounting. They are ruggedly constructed for long life and trouble-free service—and for resistance to vibration and shock. Internal construction is unusually clean in design, and provides easy accessibility to all parts.

For full information, contact your local Weston representative, or write to Daystrom-Weston Sales Division, Newark 12, N. J. *In Canada: Daystrom Ltd., 840 Caledonia Rd., Toronto 19, Ont. Export: Daystrom Int'l., 100 Empire St., Newark 12, N. J.*

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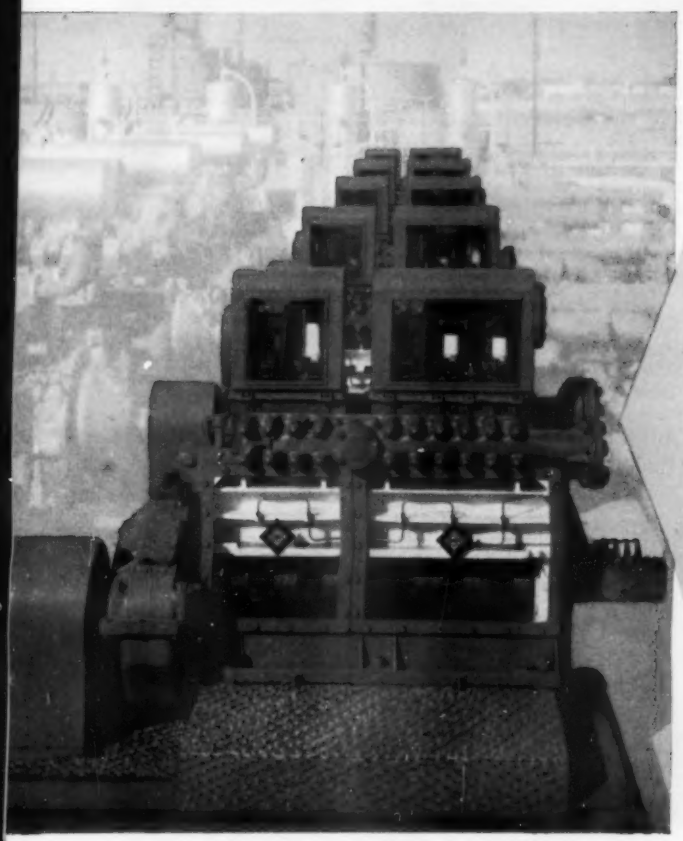
World leader in measurement and control

DAYSTROM-WESTON INDUSTRIAL INSTRUMENTS include a full line of recording and controlling potentiometers with strip and circular charts; mechanical recorders and indicators for pressure, temperature and flow; and non-indicating controllers, both electric and pneumatic.

UNDER NORMAL CONDITIONS . . .

Any Good Pump will do the Waterflood Job



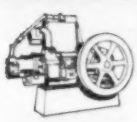
"Five Ajax Quintuplex pumps on Long Beach project."

. . . but Ajax builds in anticipation of troublesome suction conditions—water hammer—excessive loads—high stress, fatigue causing conditions . . .

Thus an Ajax pump reduces down time and increases "ON THE LINE" pumping time.

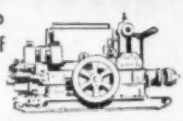
- Streamlined discharge manifold — reduces turbulence
- Double row tapered permanently factory adjusted roller main bearings result in lowered maintenance cost.
- *"Safety Link" Tie Rods* — protect vital components during highly abnormal conditions

AJAX OIL FIELD PUMPS



ENGINES

AJAX also builders of



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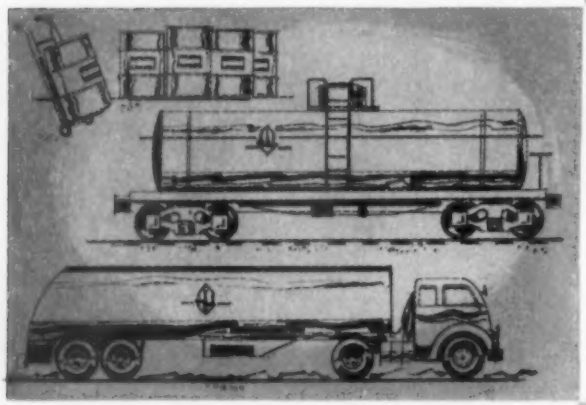

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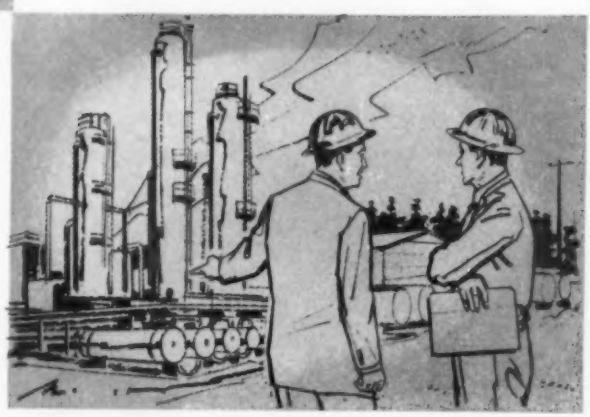
when and where and in any quantities you require . . . 55-gal. drums, 1-4,000-gal. tank wagons, 4-10,000-gal. tank cars . . . single product or combination shipments.

HELPFUL TECHNICAL SERVICES . . .

like those relating to proper storage and handling, or complete analyses of your gas-scrubbing agents, or just any way the Jefferson people can help you lick a problem. Your request to 1121 Walker Avenue, Houston 2, Texas, will bring helpful answers on the double.



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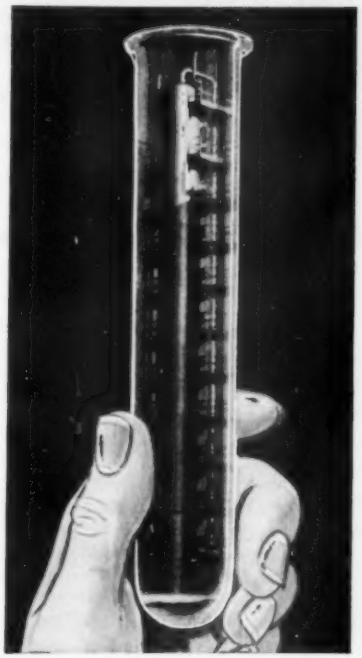

Best way to
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EXPERIENCE proves that the best way to clean a tower is the Oakite ECP way . . . which recommends chemical circulation. For one scale-choked absorber, it meant only 32 hours offstream. The tower was thoroughly cleaned in 3½ days *less* time, at $2,250 less direct cost than by previous methods.

Developed specifically for your refinery, an Oakite ENGINEERED CLEANING PROGRAM takes into account your soil problems, cleaning needs and available equipment. It makes individual cleaning recommendations for everything from tank stripping to tower turnarounds. It puts "do-it-yourself" cleaning on a practical, profitable basis.

The Oakite Engineer follows through with technical service. His personal help assures satisfaction with results. Behind him stands the finest chemical cleaning research facilities in existence. Call him in. Or write for bulletin. Oakite Products, Inc., 39 Rector Street, New York 6, N. Y.

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your economy key
In our 50th year

They Say—

Wow, Uncle, what a profit

"Federal and state gasoline taxes average about 9 cents per gallon—or 41% of the average retail price, without taxes, and 76% of the refinery price.

"While our company earned $3.29 per share for stockholders in the year 1958, it collected for government an amount equal to $10 a share in direct taxes on products."

Frank O. Prior, chairman, Standard Oil Co. (Ind.), in a statement to the press following President Eisenhower's recommendation to Congress for an increase in the direct federal tax on gasoline.

Socal views foreign taxes

"Great confusion has arisen as a result of this move by Venezuela (action raising Venezuela's income taxes). The facts are that income taxes were increased to a point where the 50% which the companies had agreed to pay was exceeded, producing taxes that in many cases will approximate 60%.

"As no contract limiting the government's authority to raise taxes existed, Venezuela was within her rights to do this, although from a business standpoint this action will undoubtedly reduce the attractiveness of that country as a place for foreign investment.

"As Middle East concessions have firm contractual agreements limiting the governments' take to 50%, the Venezuelan situation has no parallel in the Middle East. There, an increase in taxes beyond that point would amount to an abrogation of the concession contract."

R. G. Follis, chairman of the board, Standard Oil Co. of California, in a speech to company stockholders.

Oil demand may slow

"In the United States growth in the consumption of petroleum products averaged some 5% a year in the postwar period, roughly double the growth rate for total energy consumption.

"Several factors, however, indicate a slower rate of percentage growth for the future although annual growth in terms of volume

Strahman

HIGH PRESSURE GAUGES

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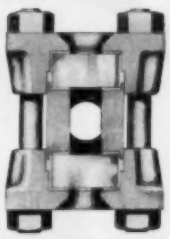
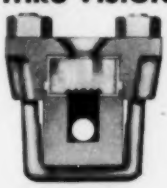


THRU VISION



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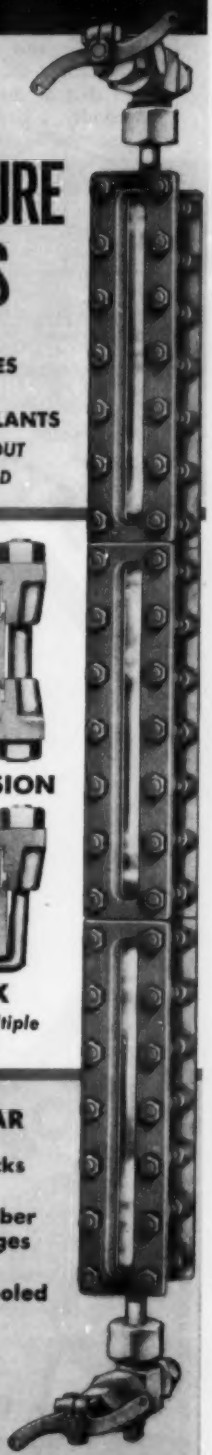


STRAHMAN VALVES, Inc.
18 Hudson St., New York 13, U.S.A.

should not diminish. First, much of the growth in oil demand was the result of a switch away from coal, particularly in the fields of home heating and public transportation. Most of this conversion has already taken place and future growth in these sectors should more nearly parallel that of the whole economy.

"Secondly, a large part of the post-war increase was contributed by motor gasoline and the record expansion in automobile ownership that occurred after 1946. No one expects this boom in private transportation to continue at quite the same pace, but we believe there is still some room to enlarge the market.

"Overall, our studies indicate petroleum consumption in the U.S. should show an average growth of about 3% a year over the next several years, although some products such as jet fuel, liquefied petroleum gas, or the petrochemicals may grow at considerably faster rates."

Stewart P. Coleman, vice president, Standard Oil Co. (N. J.), in a speech to the National Industrial Conference Board, New York.

An increase in crude prices?

"The Government has notifed the oil industry, particularly the domestic oil industry, that if the mandatory program (for imports) should bring about an increase in domestic prices —and it is hard to see how it can fail to do so—then the same government agencies will undertake to establish some form of price controls."

W. K. Whiteford, president, Gulf Oil Corp., in a letter appearing in "The Orange Disc," company publication.

Oil's role in energy picture

"I cannot help but emphasize that the prospects for the petroleum industry could be changed materially by an unwise action by state or federal agencies or by the industry itself on such matters as conservation, percentage depletion, and import policy.

"The biggest single threat now posed to low cost and abundant energy is the attack on percentage depletion. It is only by free competition that all of us can be assured a bountiful supply of low-cost energy with which to meet the competition of substitute fuels.

"Given this freedom of action, the oil industry will maintain its position in the total U.S. energy market for the foreseeable future. Its percentage of this total market is not expected to change very much in the next 15 to 20 years. Last year petroleum supplied 47% compared with 25% for coal. Hydroelectric energy and natural gas accounted for the rest.

"By 1975, these figures are expected to change relatively little. Coal will stay at about the same level, although hydro and nuclear energy may capture about 3% of oil's market.

"The four principal sources of energy that we have grown up with have now been joined by this fifth—nuclear power. While this source of energy is on the horizon, even its most enthusiastic boosters will concede that several new scientific break-throughs must be scored to bring its cost to a competitive economic level . . . "

B. W. Pickard, vice president, Standard Oil Co. of California, Western Operations, Inc., in an address to the Oil Heat Institute's national convention in Seattle.

A cockeyed conspiracy

"The Department of Justice in its zeal to enforce the antitrust laws seems to have at all times one or more suits pending against oil com-

at Tidewater's Avon Refinery:

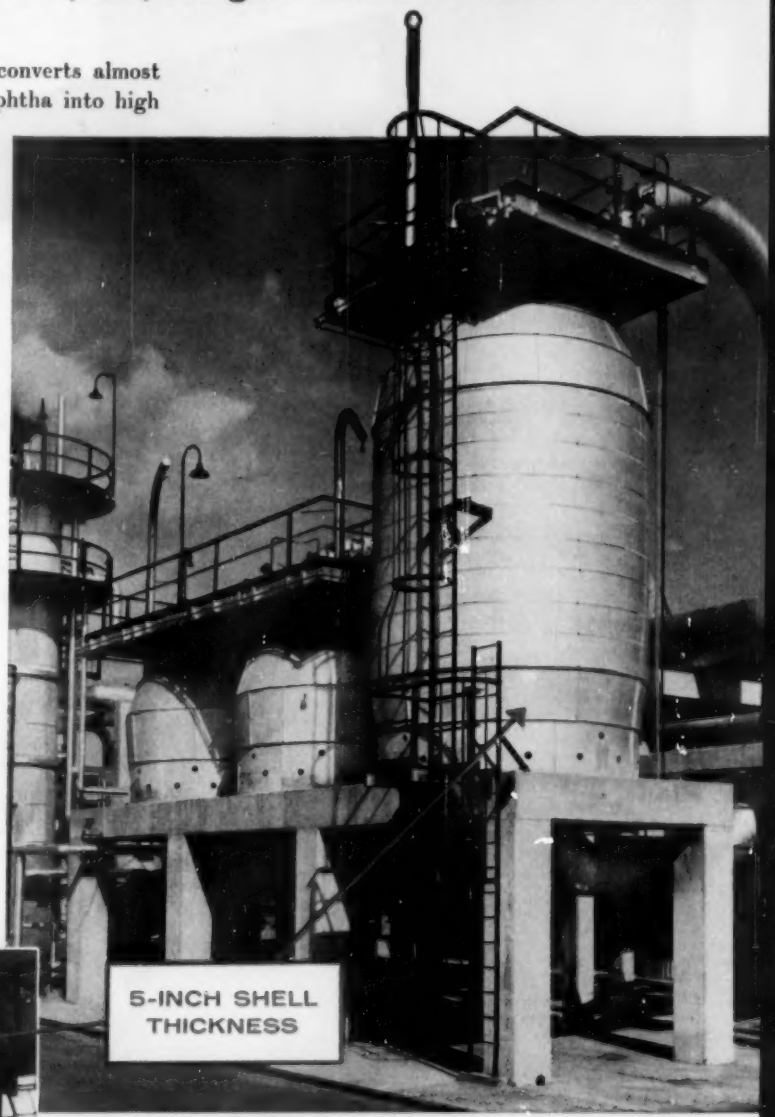
.....CB&I—built reactors serve 1,000,000-gal. HOUDRIFORMER Process...

This high severity catalytic reformer unit converts almost a million gallons per day of low octane naphtha into high octane blending stocks.

The three CB&I-built reactors incorporated in the process handle upwards of 127,000 pounds of platinum catalyst per charge. They were fabricated of plates up to 5 inches thick . . . to meet the rigid specifications dictated by extremely high and controlled temperature and pressure conditions. In addition, the critical vessels were shop X-rayed and stress relieved to insure optimum performance and long service life.

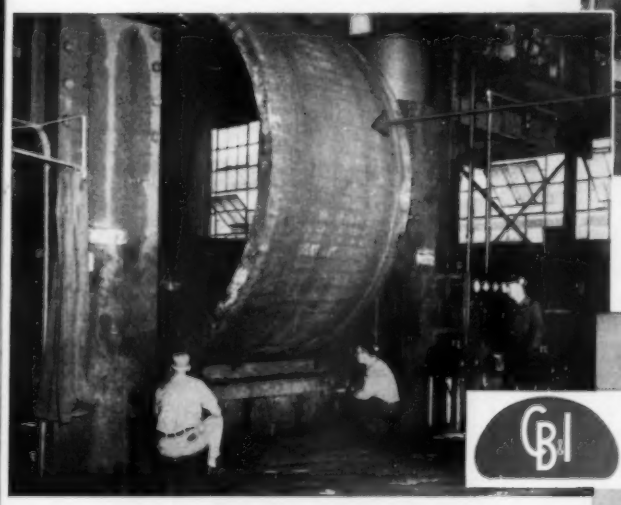
Fabricating 5-inch plate to customer or code specifications is not an unusual job for CB&I. Increased complexity in refining operations demands the exacting attention to detail made possible by CB&I's advanced metallurgical facilities.

Creative fabrication, combined with experienced and *coordinated* engineering and erection services is the reason leading processors rely on CB&I for the tanks, towers and processing vessels which help to keep them abreast of petroleum progress. Write our nearest office for the bulletin: *CB&I Creative Craftsmanship in Steel.*



CB&I-built reactors contain catalyst for *Houdriformer*—high severity reforming process. Hydrogen by-product, generated in process, is recovered for use in another process that removes nitrogen and sulfur compounds from gasoline and propane.

Reactors were furnished through the Bechtel Corporation.



Five-inch thick plate for walls of large reactor (shown above) was fabricated at CB&I Birmingham plant.

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You can run fuel oil, gasoline, processing oils, and many other petroleum products through Quaker Petroflo Hose. Its Buna-N tube resists a wider range of attack than neoprene-type tubes do. It'll take a beating!

Horizontal braiding of rayon yarn with spring-steel wire gives Petroflo maximum flexibility with kink-resistance even in sharp bends. The extra spiral-wire reinforcement can be grounded to couplings for static-elimination.

Inside diameters 1¼" to 4"; lengths to 50 feet; standard reattachable or non-reattachable couplings; 100-lb. working pressure in all sizes—suitable for suction use too.

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panies for collusion and conspiracy to fix gasoline prices.

"It is indeed a poor compliment to the management of oil companies to suggest that such a crazy market could be the result of deliberate arrangement."

H. S. M. Burns, president, Shell Oil Co., in a speech to the Independent Petroleum Association of America, Phoenix.

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR

MAY

30-June 5 Fifth World Petroleum Congress, Coliseum, New York.

JUNE

2-4 Appalachian Underground Corrosion Short Course, University of West Virginia, School of Mines, Morgantown, W. Va.

4-5 Kentucky Oil and Gas Association, annual meeting, Phoenix Hotel, Lexington.

8-9 University of Michigan, School of Public Health and College of Engineering, short course on industrial water conservation, Ann Arbor, Mich.

9-10 Petroleum Electric Power Association, annual meeting, Hotel Galvez, Galveston, Tex.

10 American Association of Oil Well Drilling Contractors, tristate chapter, annual safety clinic, Carmi, Ill.

10-12 Instrument Society of America, second international symposium on gas chromatography, East Lansing, Mich.

10-13 American Association of Petroleum Landmen, fifth annual convention, Skirvin Hotel, Oklahoma City.

11-12 Southern Research Institute, conference on "The Undiscovered Earth," Birmingham, Ala.

11-13 National Oil Scouts and Landmen's Association, annual meeting, Hilton Hotel, San Antonio, Tex.

14-18 American Society of Mechanical Engineers, semiannual meeting, Chase and Park Plaza Hotels, St. Louis.

14-19 Society of Automotive Engineers, summer meeting, Chalfonte-Haddon Hall, Atlantic City.

15-17 Interstate Oil Compact Commission, midyear meeting, Roosevelt Hotel, New Orleans

21-26 American Society for Testing Materials, annual meeting, Chalfonte-Haddon Hall, Atlantic City.

22-23 Michigan Gas Association, Grand Hotel, Mackinac Island, Mich.

22-24 Canadian Gas Association, annual meeting, Empress Hotel, Victoria, B.C.

22-26 Air Pollution Control Association annual meeting, Statler-Hilton Hotel, Los Angeles.

22-26 Gordon Research Conferences, petroleum, Colby Junior College, New London, N. H.

22-26 Massachusetts Institute of Technology, National Association of Corrosion Engineers, short course on fundamentals of corrosion reactions and corrosion control, MIT, Cambridge, Mass.

" . . . advanced technology and methods"

"In an industry such as ours, an industry whose accomplishments are little short of phenomenal, it is difficult to praise any one segment without deep consideration.

"Great contributions have been made by all elements. Cooperation between operating companies, manufacturers, drilling contractors, and service and supply companies has made possible the growth and progress our industry enjoys.

"Service companies, for instance, have given us advanced technology and methods for finding and producing oil and gas. These services are available when and where they are needed, at any time day or night, in any weather.

"Behind each drilling rig, each refinery, each gas plant or pipe line operation stands the manufacturer, the supplier and the service man. They provide engineering, research, products and services to keep the industry humming.

"As I said, it's hard to praise just one segment of the industry, but one thing is certain, all our jobs have been made easier and better because of the companies and men who give the service."

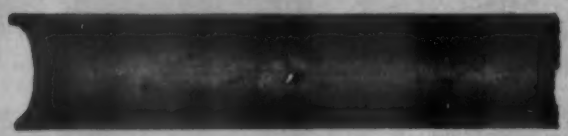
J. L. LATIMER,
President,
Magnolia Petroleum Company

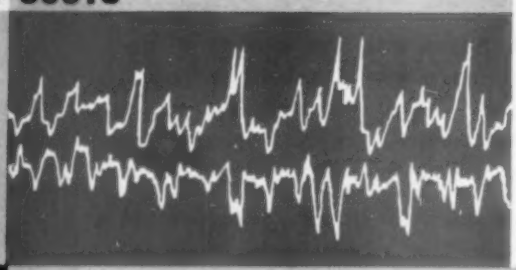
P.E.S.A.

PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION

PROUD TO BE PART OF A PIONEERING INDUSTRY

TUBOSCOPE CUTS PRODUCTION COSTS





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24-25 Western Petroleum Refiners Association, Mid-Continent regional technical-industrial relations meeting, Broadview Hotel, Wichita.

26 Southern Gas Association, compressor station conference, Dinkler-Tutwiler Hotel, Birmingham, Ala.

29-July 3 Gordon Research Conferences, catalysis, Colby Junior College, New London, N. H.

JULY

6-15 University of Michigan, short course on underground storage of natural gas, Ann Arbor, Mich.

16-17 University of Michigan, research conference on underground storage of natural gas, Ann Arbor, Mich.

27-31 University of Minnesota, continuation course, techniques of chemical infrared spectroscopy, Minneapolis.

AUGUST

3-7 University of Minnesota, continuation course, chemical interpretation of infrared spectra, Minneapolis.

10-13 Society of Automotive Engineers, national West Coast meeting, Hotel Georgia, Vancouver, B. C.

12-15 Billings, Mont., Geological Society, tenth annual field conference, Disturbed Belt area of northwestern Montana, registration, August 12, Great Falls, Mont.

24-26 West Virginia University, annual Appalachian gas measurement short course, Morgantown, W. Va.

27 Oil Centennial Day, Titusville, Pa.

26-28 Pennsylvania Grade Crude Oil Association and Pennsylvania State University, twenty-first technical conference on petroleum production, Penn State campus, University Park, Pa.

SEPTEMBER

9-11 Pacific Coast Gas Association, annual meeting, Ambassador Hotel, Los Angeles.

10-12 Magic Plains Oil Exposition, Borger, Tex.

14-16 Texas Mid-Continent Oil and Gas Association, annual meeting, Rice Hotel, Houston.

16-18 National Petroleum Association, annual meeting, Traymore Hotel, Atlantic City, N. J.

17 Natural Gasoline Association of America, Rocky Mountain regional meeting, Wyoming-Gladstone Hotel, Casper, Wyo.

20-23 American Society of Mechanical Engineers, petroleum mechanical engineering conference, Rice Hotel, Houston.

21-25 Instrument Society of America, annual instrument-automation conference and exhibit, International Amphitheater, Chicago.

23-24 Western Petroleum Refiners Association, Rocky Mountain regional technical-industrial relations meeting, Henning Hotel, Casper, Wyo.

24-25 Mid-Continent Oil and Gas Association, Louisiana-Arkansas division annual meeting, Roosevelt Hotel, New Orleans.

27-29 National Association of Oil Equipment Jobbers, annual convention and trade show, Hotel Leamington, Minneapolis.

28-Oct. 1 American Welding Society, fall meeting, Sheraton-Cadillac Hotel, Detroit.

29-30 Western Petroleum Refiners Association, management seminar, Western Hills, Waggoner, Okla.

29-Oct. 1 Engineers, western region conference, Bakersfield Inn, Bakersfield, Calif.

OCTOBER

1-2 National Association of Corrosion Engineers, southeast region conference, Jacksonville, Fla.

2-3 Association of Desk and Derrick Clubs of North America, eighth annual convention, Hilton Hotel, San Antonio, Tex.

4-7 Society of Petroleum Engineers of AIME, fall meeting, Memorial Auditorium, Dallas, Tex.

5-7 American Gas Association, annual meeting, Conrad Hilton Hotel, Chicago.

5-7 National Association of Corrosion Engineers, northeast region conference, Lord Baltimore Hotel, Baltimore.

5-10 Society of Automotive Engineers, national aeronautic meeting, aircraft manufacturing forum, and aircraft engineering display, The Ambassador, Los Angeles.

7-8 Western Petroleum Refiners Association, fourth annual stream pollution and waste disposal conference, Broadview Hotel, Wichita.

7-10 Rocky Mountain Association of Geologists, eleventh annual field conference, Saratoga Inn, Saratoga, Wyo.

8-9 California Natural Gasoline Association annual fall meeting, Huntington-Sheraton Hotel, Pasadena, Calif.

8-10 Southwestern Federation of Geological Societies, annual meeting, Lubbock, Tex.

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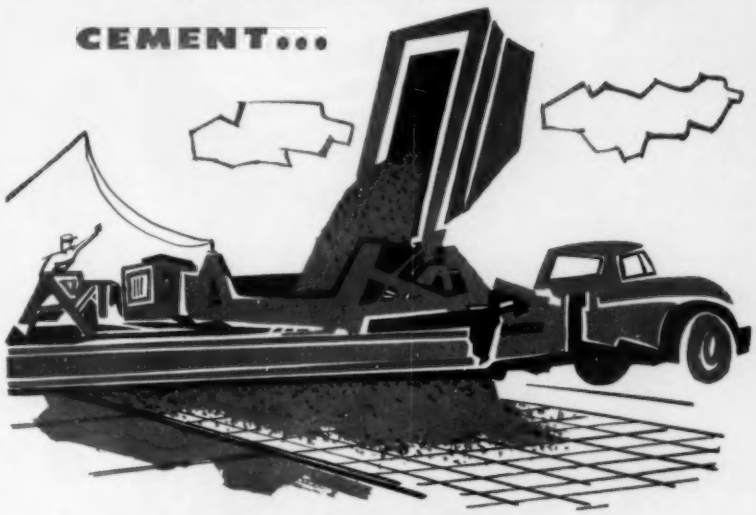

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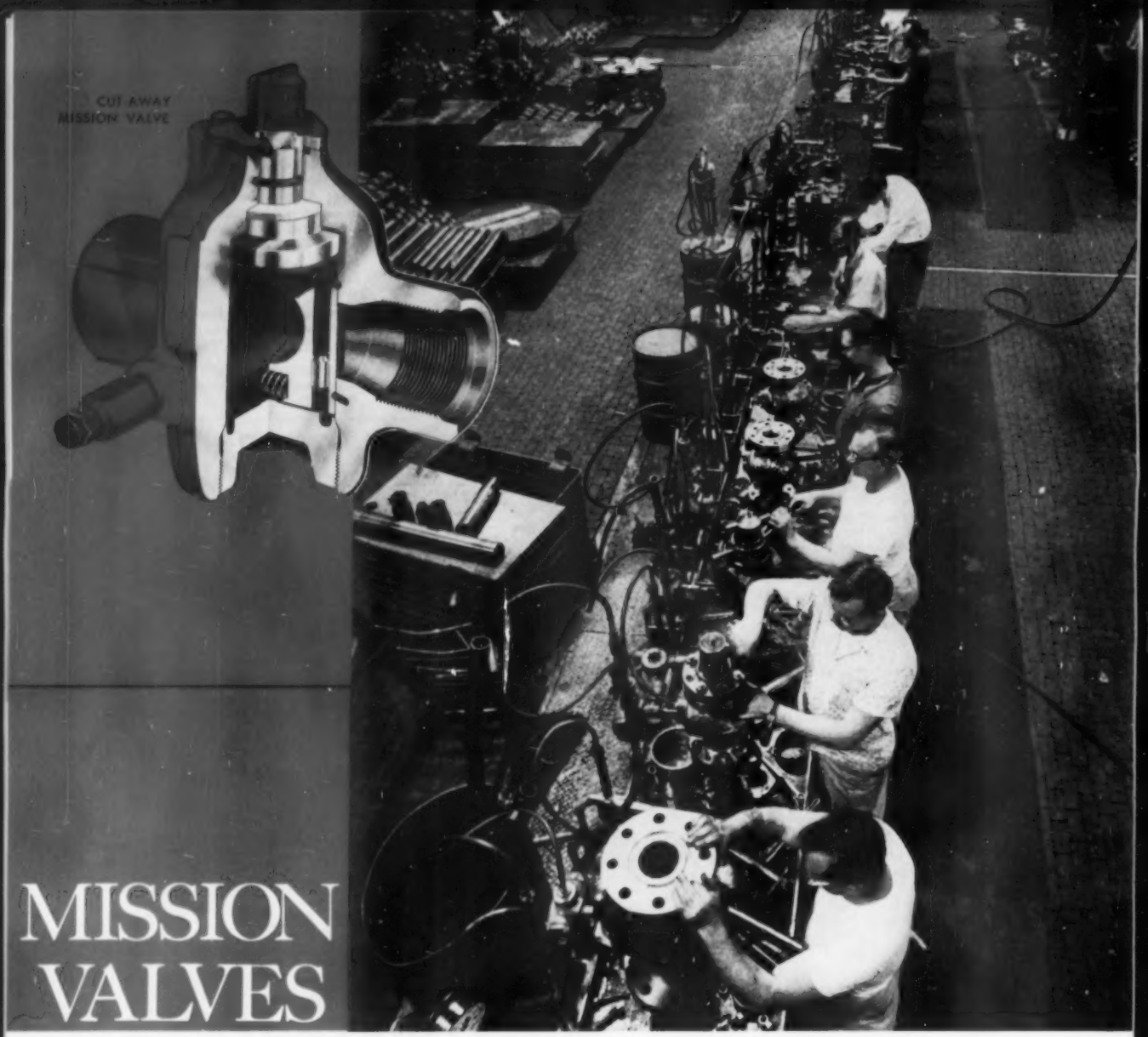

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JOURNALLY SPEAKING

When Greek Meets Greek

THERE'S AN OLD SAYING that starts "When Greek meets Greek . . ." We forget how it ends, or what two Greeks do when they meet. Maybe they open a restaurant.

But what happens when oil man meets oil man?

You might make several guesses. They complain about low prices, high taxes, tough competition, federal regulation? They pull out a map and exchange tips on the latest hot area for wildcatting?

No, not according to a trained observer with an outsider's viewpoint.

This fellow is a long-time newspaper editor who has had very little contact with oil men.

He happened to be vacationing in a city that was host to a convention of oil producers, so he decided to sit in on the proceedings. It was partly a busman's holiday—a lifetime habit of covering meetings and speeches—and partly just plain curiosity.

He wanted to see what real, live oil men looked like, whether their horns and tails showed, and what they talk about when they get together in a room and let their hair down. Perhaps he half expected to find them conspiring to form a monopoly and gouge the public.

We talked with him afterward, and asked him his main impression of the meeting.

"I was amazed and amused," he said. "The chief topic of conversation was what poor public relations the oil industry has and how nobody does anything about it.

"It wasn't on the program, but that was the main theme of the whole convention, it seemed to me. Just about every speaker worked in some crack about how the oil industry doesn't present itself to the public properly. And all the delegates agreed completely and thought it was too bad that something isn't done to correct it. It was the same in all the informal conversations I overheard around the hotel.

"It just seemed to be taken for granted that the oil industry's public relations are terrible and that nothing can be done about it.

"I was amused because as a newspaperman I've been on the receiving end of a lot of the industry's poor public relations, and I could tell these men plenty about how lousy they are. Sometime let me tell you about some of the things the oil people did wrong in my state—how they took narrow, selfish stands against the public interest, how they antagonized the legislature and the newspapers and the public, how they seemed to go out of their way to put themselves in a bad light.

"I admit I have been somewhat prejudiced against oil men. Now I'm beginning to believe that this is due in very large part to the stupid tactics oil men have used in dealing with the public. As an editor I try to be open minded, but I swear I haven't been able to see much good in what the oil industry appeared to be doing in my state.

"So I was amazed to discover that the oil men themselves realize that they have a problem here. I assumed that they thought they were doing everything right.

"But it struck me as pretty funny that man after man loudly proclaimed that public relations is the industry's biggest problem and in the same breath bemoaned the fact that nobody does anything about it. I never saw such a frustrated bunch. It was quite enlightening to eavesdrop on this convention."

Well, there's one man's reaction. We mulled it over a while and then decided that he was entirely right. We had heard the same sort of talk so often that we had become immune to it, and it took an outsider to point out the obvious.

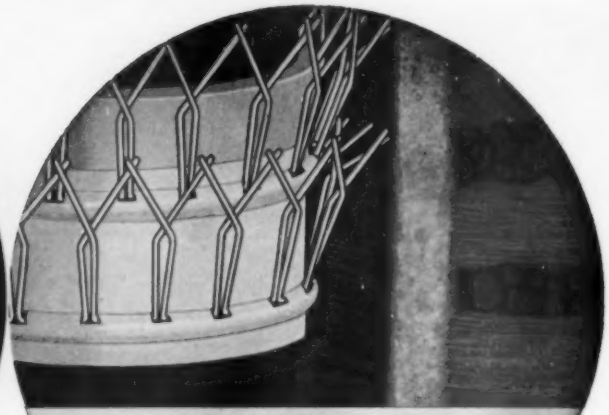
It has happened at a great many oil-industry meetings we have attended during the past couple of years. No matter what the announced topic of the program, the discussion soon gets around to how the industry can improve its relations with the public. Nearly everybody asks the question but hardly anybody has any answers. It must be quite amusing to an outside observer.

Our editor friend is right. When oil man meets oil man they talk about how nobody is doing anything to improve their public relations.

—Henry D. Ralph

BAKER CONTROLLED SCRATCHING

OFFERS MORE THAN EFFECTIVE MUD CAKE REMOVAL

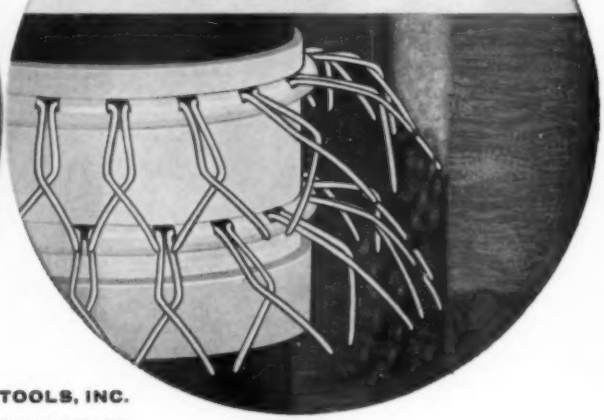


When the casing is being lowered, the scratcher wires swing freely upward and do not remove mud cake which can plug the annulus and cause dangerous pressure surge build-up.

BAKER

After reaching the area to be cemented, the hinged scratcher wires extend to contact the wall of the hole, and when the casing is reciprocated...

...scissors-like operation of the overlapped wires—over the full circumference of the well bore—effectively removes the mud cake which is circulated safely out of the hole.



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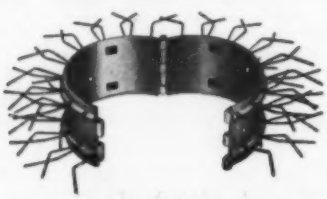


Why are oil men so jittery now?

THE whole domestic oil industry is "running scared" at the moment. It has a bad case of jitters over weak products markets, high refinery runs, and excessive stocks.

Crude allowables and refinery runs are properly being cut to correct excesses of a month or two ago, but the underlying motivation seems to be a frantic feeling of impending disaster.

Crude purchasers seem to want to buy only on a hand-to-mouth basis, possibly because they fear a price cut that would leave them with costly inventories. Apparently a similar distrust of products prices is inducing some refiners to get rid of their stocks as quickly as possible.

THINGS AREN'T AS BAD as all that. The ailment is partly psychosomatic. The industry is like a hypochondriac patient who feels a lot sicker than his fever chart shows he is.

The statistical supply-demand picture is not the best, but neither is it discouragingly dismal.

Product stocks are higher than necessary, but not to the point of imminent disaster. Refinery runs were too high in March and April, but some compensating corrections are being made now. Imports of crude and products should hold steady at their current lower levels. Crude stocks are reasonable and probably will decline in June.

Demand has been encouragingly higher than last year during several recent months, and the summer motoring season is right at hand. The general business outlook is for increased economic activity and consumer spending.

So . . . much of the industry's sick feeling is self-induced. It can be laid to the typical oil man's manic-depressive habit of swinging from extremes of exuberance and doubt, of being influenced more by the "feel" of things than by cold calculations, of acting on immediate conditions rather than on long-range probabilities.

Too much immediate benefit was read into encouraging events of the past few months—the winter consumption of heating oil, imposition of controls on imports, forecasts of higher 1959 demand. When results weren't as large or as early as anticipated, undue optimism swung to undue pessimism.

WHAT'S NEEDED NOW is a shock treatment of reality. A dispassionate examination of the present economic status and the outlook for the second half of the year should remove most of the jitters.

The industry may have to walk a supply-demand tightrope for a few months, but if it will keep its shirt on and tread warily it can make it. An upturn is at hand and everything will be much better in the fall—provided the industry doesn't set back its own recovery by panicking now.

A steady hand on crude and products output, a determination to carry but not increase inventories, sound marketing practices, and a long-range look can keep the industry on an even keel this summer.

How to Predict Octane Numbers of Multi-Component Blends

Ethyl Research Develops Equations for Calculation of Research and Motor Octane Numbers of Gasoline Blends

Accurate predictions of final blend octane numbers are necessary in any paper study of the refinery gasoline pool.

But linear calculation of final blend octane numbers generally is unsatisfactory. Volumetric average values will be higher or lower because of differences such as antiknock rating, hydrocarbon type, etc., in fuel components.

One common practice has been to introduce a blending factor to correct the final octane number. Generally, this works quite well once a given blending situation has been established.

However, none of the many techniques suggested for predicting blending deviation has proved to be so universally adaptable that it can be relied upon for broad application.

Predicting Blending Deviation by Equation. Ethyl Research has developed equations that are accurate for calculating both Research and Motor octane numbers. These equations may be applied in specific refining situations for both operating and economic calculations, or for wider, industry-type studies.

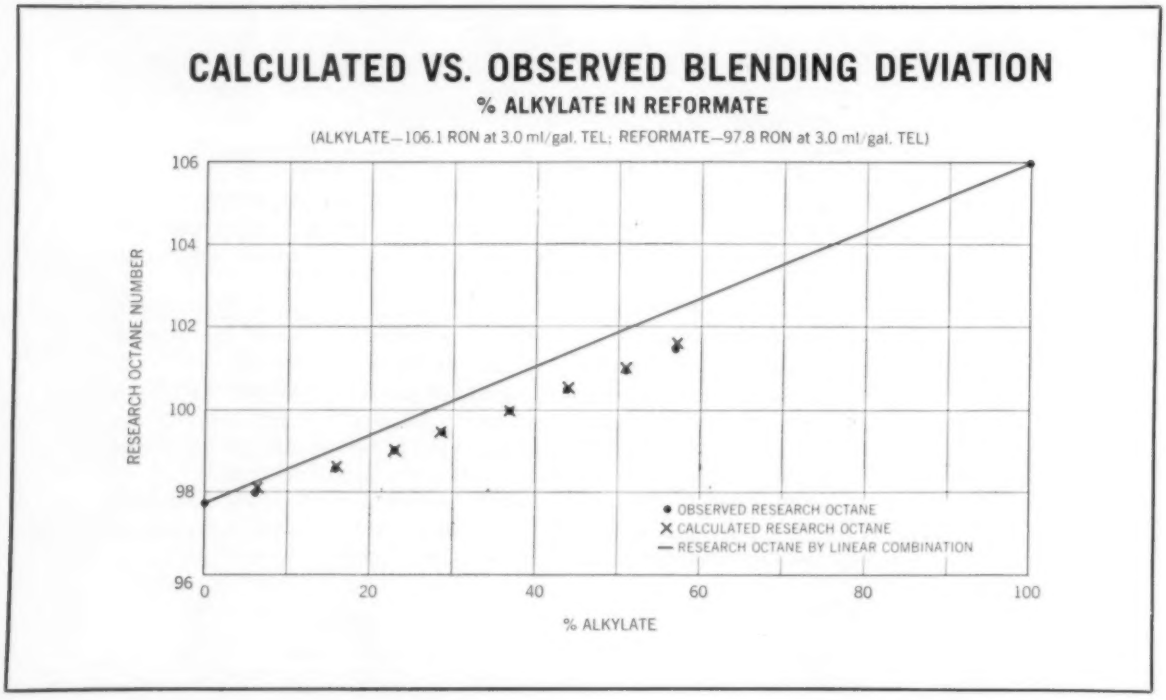
The equations fill the following requirements necessary to a good predicting technique:

They are accurate over a wide range of components and blends, since almost all possible types of gasoline components were included in the study.

They retain simplicity consistent with accuracy.

They are set up to handle different TEL levels.

While the equations were developed for use with high speed computers, they also are suitable for calculation with desk-type machines.



The Research Octane Number Equation

The equation for calculating Research octane is as follows:

$$R = \bar{r} + a_1\left[(\overline{rj}) - (\bar{r})\,(\bar{j})\right] + a_2\left[(\overline{0^2}) - (\bar{0})^2\right] + a_3\left[(\overline{A^2}) - (\bar{A})^2\right]$$

where:

- R = Research octane number of the blend.
- r = Research octane number of each component.
- j = Sensitivity (Research octane number minus Motor octane number) of each component.
- a = Equation coefficient.
- $\bar{r}$ = Volumetric-average Research octane number.
- $\bar{j}$ = Volumetric-average sensitivity.
- $\overline{rj}$ = Volumetric-average of the product of r and j.
- $\overline{0^2}$ = Volumetric-average of the square of the olefin content in volume percent.
- $\bar{0}^2$ = Square of the volumetric-average olefin content in volume percent.
- $\overline{A^2}$ = Volumetric-average of the square of the aromatic content in volume percent.
- $\bar{A}^2$ = Square of the volumetric-average aromatic content in volume percent.

Equation coefficients have been established for use at tetraethyllead (TEL) concentrations of 3.0, 1.5 and 0.0 ml./gallon. Other TEL concentrations may be found by interpolation using TEL susceptibility charts.

A similar equation has been developed for calculating motor octane number.

Scope and Range of Development Data. Equations were developed by the method of least squares from 187 blends covering a wide range of finished gasolines. At each of three TEL levels, 135 blends out of 187 blends were selected for use in deriving and checking the blending equations. Fuels were from 24 refineries representing a good average of all U. S. facilities.

The number of components in the blends varied from 2 to 15. Component properties examined were Research octane number, Motor octane number, sensitivity, olefin content, aromatic content, sulfur content, gravity, and the 50 percent ASTM distillation temperatures.

TABLE 1 Gasoline Components Represented in Blends Used to Develop Predicting Equations

Alkylate	Aromatic Concentrate
Butane	Aromatic Raffinate
Catalytically Cracked Naphtha	C_5 and C_6 Isomers
Natural Gasoline	Pentane
Polymer	Reformate
Thermal Reformate	Thermally Cracked Naphtha

Several types of alkylate, reformate, catalytically cracked naphtha and other components were represented.

TABLE 2 Range of Properties of Blend Components and Blends Used to Develop Predicting Equations

Properties	Blend Component	Blend Range
Research Octane No.	59-113	85-105
Motor Octane No.	62-107	79-103
Olefin content, Vol %	0-100	0-60
Aromatic content, Vol %	0-96	0-70
Saturate content	0-100	25-86
Sulfur, Weight %	0-0.643	0.01-0.227

How Ethyl Research can help you

The accuracy of predictions can be improved by tailoring these equations to individual refining situations.

Ethyl Refinery Technologists are ready to work with you to establish equation coefficients from your blending data.

For an appointment with one of these specialists, see your Ethyl Representative.

Your Ethyl Representative also can supply you with a detailed engineering report of this study which served as a basis for the presentation, "A New Approach to Blending Octanes" at the New York meeting of the API, Division of Refining.

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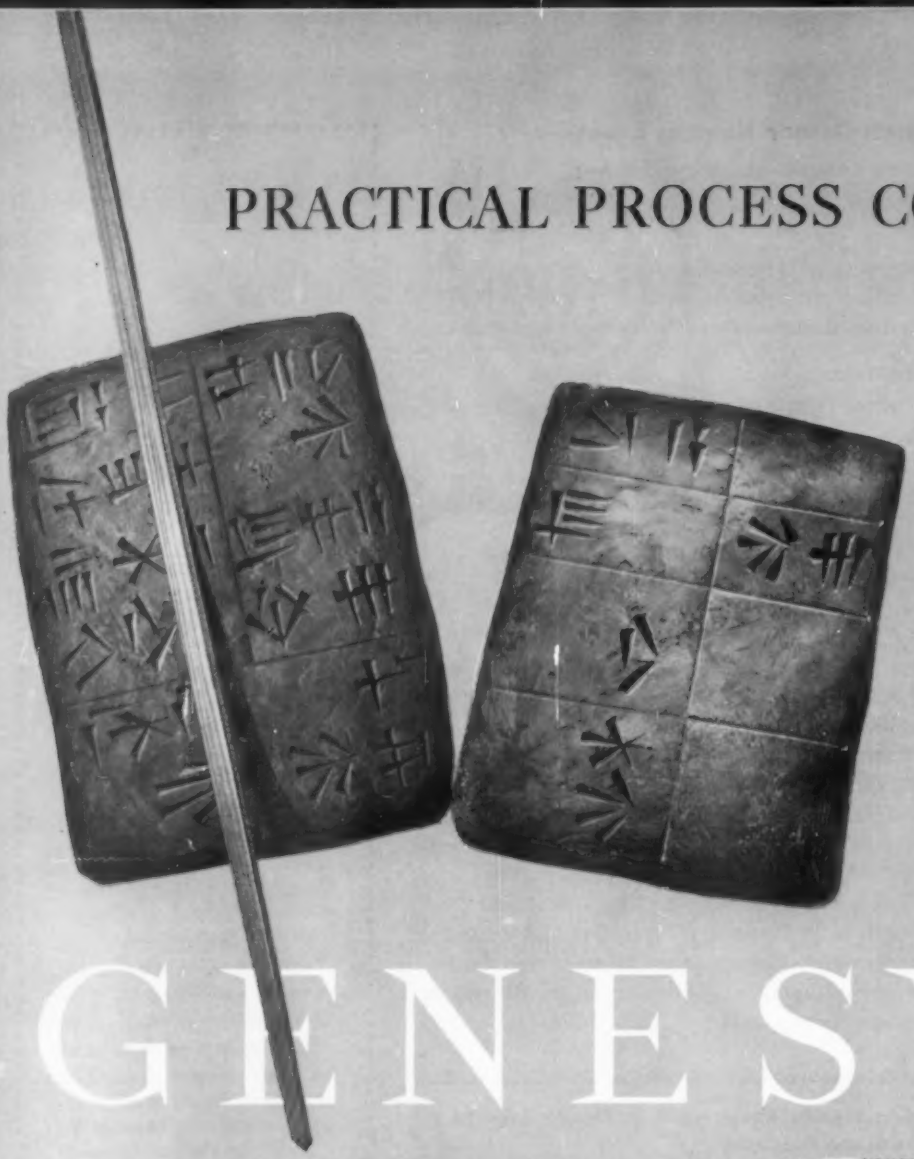

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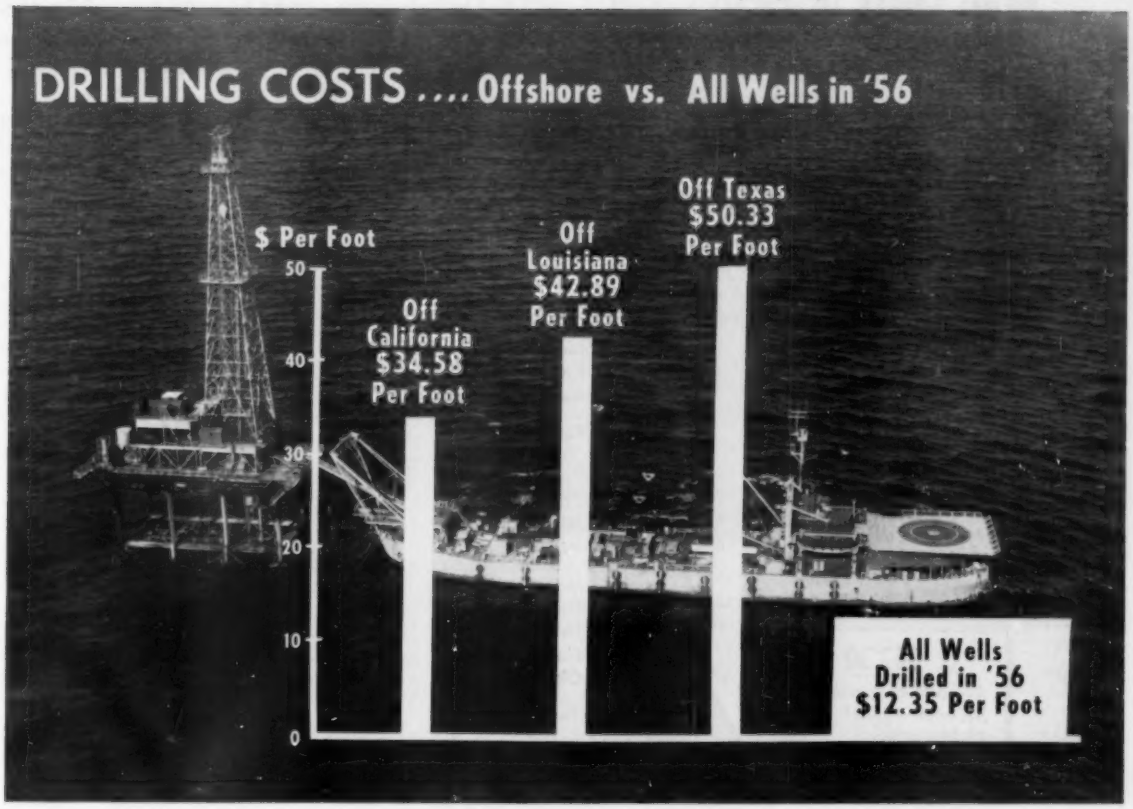


Well Costs Continue to Skyrocket

• Oil industry handed new statistics on drilling expenditures. They show deeper wells and offshore activity play major roles in boosting costs.

AS EVERY OIL MAN knows, the costs of putting down a well have headed into outer space in recent years. They show no signs of coming down, either.

Now a special cost report on drilling is available to help every operator determine how he stacks up with industry averages. The industrywide study, the second ever compiled, was made by the API, IPAA, and the Mid-Continent Oil & Gas Association and was based on 1955 and 1956 data.

The study briefly showed:

... **Average cost per producing well** rose from $51,900 in 1955 to $55,600 in 1956.

... **Average cost per dry hole** also rose from $37,300 in 1955 to $41,600 in 1956.

... **Average per-well cost** went up from $46,500 in 1955 to $50,200 in 1956.

... **Cost per foot** rose in all categories.

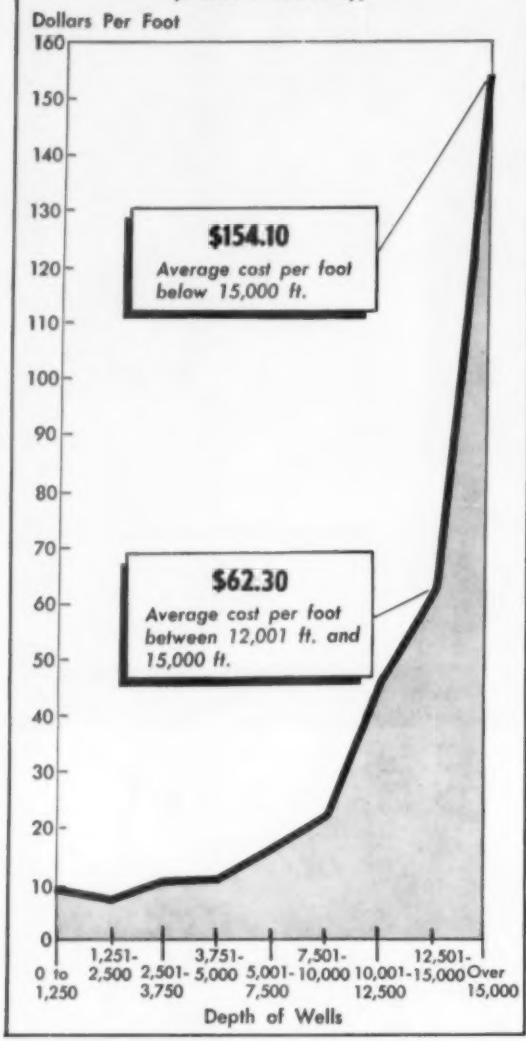
On productive wells, footage cost went from $12.94 in 1955 to $13.64 in 1956 and dry holes from $9.21 to $10.26. In 1955, the footage costs on productive wells were split at $9.47 for intangible costs and $3.47 for tangibles. In 1956 the split was $9.97

DRILLING SUMMARY . . . wells are deeper, costs are higher

	Productive Wells		Dry Holes		Total	
	1955	1956	1955	1956	1955	1956
Wells Drilled	35,185	35,280	20,746	21,845	55,931	57,125
Footage Drilled (Thousands)	141,111	143,611	84,046	88,563	225,157	232,174
Expenditures (Millions)	$1,826	$1,959	$774	$909	$2,600	$2,868
Average Depth	4,011	4,071	4,051	4,054	4,026	4,064
Cost Per Well	$51,900	$55,600	$37,300	$41,600	$46,500	$50,200
Cost Per Foot	$12.94	$13.64	$9.21	$10.26	$11.55	$12.35

Well Costs in 1956

(Average for drilling and equipping productive wells only)



A State-by-State

1955

	Productive Wells: Wells Drilled	Total Footage (1,000 ft.)	Cost ($1,000)
Alabama	1	12	225
Arkansas	439	1,330	10,716
California:*			
Onshore	....	....	....
Offshore	....	....	....
Total	1,811	9,282	168,525
Colorado	486	2,606	22,176
Illinois	2,116	5,205	42,208
Indiana	227	374	2,930
Kansas	2,796	9,323	85,796
Kentucky	816	1,185	10,226
Louisiana:			
Onshore	2,546	14,038	252,308
Offshore	292	2,756	106,286
Total	2,838	16,794	358,594
Michigan	213	660	5,529
Mississippi	181	1,534	22,285
Montana	186	957	14,778
Nebraska	311	1,802	13,154
New Mexico	1,423	5,986	84,753
North Dakota	165	1,272	15,945
Oklahoma	5,490	18,727	206,423
Texas:			
Dist. 1 & 4	1,860	6,676	70,188
Dist. 2 & 3	1,390	8,488	107,583
Dist. 5 & 6	505	2,574	33,961
Dist. 7B & 9	4,398	13,999	126,812
Dist. 7C & 8	3,949	21,337	295,828
Dist. 10	960	3,215	33,466
Offshore	17	168	10,645
Total (Texas)	13,079	56,457	678,483
Utah	24	124	3,588
Wyoming	484	2,460	43,663
Appalachian†	2,084	4,948	33,755
Other States‡	15	73	1,973
Total United States	**35,185**	**141,111**	**1,825,725**

*There was no breakdown between offshore and onshore wells in the '55 report on California.

a foot for intangibles and $3.67 for tangibles.

The reasons . . . Chief explanations for the continued rise in drilling costs aren't too difficult to find.

They show high costs are due to:

. . . Increased offshore activity where costs averaged almost nine times more than those on dry land.

. . . Deeper holes where costs skyrocket as depths increase. One example: Wells over 15,000 ft. cost nearly 29 times more than those in the relatively shallow areas of 2,500 to 3,750 ft.

. . . Higher prices for labor and drilling materials.

What's just as important, the labor and materials costs have continued to rise since 1956. This means that current drilling costs per foot doubtless average higher than reported for 1956.

The report cites these examples:

. . . Hourly wages in oil drilling and producing operations averaged 8.5% above the 1956 average.

. . . Average type J-55 casing price in 1958 was 15.7% above the average in 1956.

It could be the same story in 1959. Bulk of oil-industry labor received a 5% wage increase early in the year. Steel prices very well could rise in the last half depending on the outcome of current steel-labor talks.

In all, the oil industry invested $5,468,000,000 in drilling 113,056 wells in the 2 years of 1955 and 1956. Of this $1,683,000,000 went down the drain for 42,591 dry holes.

These costs do not tell the full story of capital required in finding oil. The expenditures in the study included only the actual costs of drilling and equipping wells through the Christmas tree at the wellhead. Administrative overhead was not allocated. Outlays for pumping equipment, flow lines, water and gas separators, storage tanks, and other lease equipment were not included. Also, the large predrilling and exploration expenditures were not covered.

About the survey . . . The latest study on drilling costs actually is one of three available recently to the industry.

An industry-wide survey was made

Recap of Drilling During 1955 and 1956

1955 Dry Holes: Wells Drilled	1955 Dry Holes: Total Footage (1,000 ft.)	1955 Dry Holes: Cost ($1,000)	1955 Total Cost $1,000)	1956 Productive Wells: Wells Drilled	1956 Productive Wells: Total Footage (1,000 ft.)	1956 Productive Wells: Cost ($1,000)	1956 Dry Holes: Wells Drilled	1956 Dry Holes: Total Footage (1,000 ft.)	1956 Dry Holes: Cost ($1,000)	1956 Total Cost $1,000)
40	189	1,581	1,806	57	593	10,171	34	207	1,806	11,977
364	1,295	6,614	17,330	670	1,861	17,162	332	1,144	6,677	23,839
....	....	....	....	1,722	7,617	147,057	568	2,833	43,397	190,454
....	....	....	....	9	60	1,947	5	51	1,891	3,838
644	3,416	56,391	224,916	1,731	7,677	149,004	573	2,884	45,288	194,292
1,023	5,497	28,125	50,301	358	1,898	2,143	864	4,334	33,286	55,429
1,773	4,095	23,805	66,013	1,737	4,093	33,650	2,066	4,673	26,573	60,223
477	727	4,109	7,039	295	510	4,712	439	718	4,229	9,941
2,149	8,254	47,448	133,244	2,621	8,864	85,323	2,242	8,107	48,304	133,627
774	1,185	7,180	17,406	960	1,317	12,474	971	1,425	10,471	22,945
1,080	8,332	131,471	383,779	2,196	14,284	309,070	1,250	10,026	176,870	485,940
96	945	38,052	144,338	287	2,693	108,856	139	1,429	67,922	176,778
1,176	9,277	169,523	528,117	2,483	16,977	417,926	1,389	11,455	244,792	662,718
298	862	5,343	10,872	214	651	6,146	223	611	3,826	9,972
267	1,805	16,190	38,475	150	1,120	13,872	291	2,074	17,659	31,531
225	971	12,509	27,287	241	1,341	21,741	253	1,098	13,396	35,137
580	3,194	13,967	27,121	302	1,766	12,815	616	3,435	13,224	26,039
240	1,060	13,901	98,654	1,535	6,622	99,744	369	1,836	25,086	124,830
85	502	4,993	20,938	164	1,384	17,544	99	593	5,766	23,310
2,588	8,315	65,075	271,498	5,146	18,611	212,277	2,476	8,346	70,873	283,150
1,220	4,993	40,418	110,881	1,777	6,774	70,203	1,287	5,326	46,845	117,048
1,100	7,410	71,323	178,906	1,498	9,704	127,801	1,098	7,499	76,339	204,140
479	2,310	17,589	51,550	567	2,927	31,605	564	2,749	21,063	52,668
3,034	8,980	54,753	181,565	4,184	13,255	119,968	3,417	10,036	54,909	174,877
954	5,212	59,366	355,194	4,768	23,654	330,032	939	5,010	61,962	391,994
95	506	5,741	39,207	1,169	4,271	52,560	153	931	12,358	64,918
9	91	5,236	15,881	13	120	5,077	26	240	13,093	18,170
6,891	29,502	254,426	932,909	13,976	60,705	737,246	7,484	31,791	286,569	1,023,815
68	273	5,666	9,254	59	354	10,488	82	336	9,183	19,671
431	2,026	25,126	68,789	500	2,111	36,511	430	1,855	29,135	65,646
558	1,177	6,114	39,869	2,061	5,099	37,793	523	1,308	6,842	44,635
95	424	6,332	8,305	20	57	607	89	333	5,076	5,683
20,746	**84,046**	**774,418**	**2,600,143**	**35,280**	**143,611**	**1,959,349**	**21,845**	**88,563**	**909,061**	**2,868,410**

†Includes New York, Ohio, Pennsylvania and West Virginia. ‡Includes Arizona, Florida, Georgia, Idaho, Maryland, Missouri, Nevada, Oregon, South Dakota, Tennessee, Virginia and Washington.

by the associations on costs in 1953 and the Census of Minerals Industries taken by the Government in 1954 covered the drilling industry.

Economists who have reviewed the gross data on the 1953 survey now say the average costs reported then may have been slightly high. This probably was due to a higher proportion of producing wells reported.

The 1953 survey estimated the cost of an average well at $12.43 per foot. The 1955-56 survey gave $11.55 per foot as the 1955 average and $12.35 for 1956.

The Census report put cost of the average productive well at $12.56 per foot in 1954. Costs climbed, according to the current study, to $12.94 in 1955 and $13.64 in 1956. The dry-hole costs were $8.06 per foot in 1954, and $9.21 in 1955 and $10.26 in 1956. The drilling-cost increase was about 5% from 1954 to 1955 and about 7% from 1955 to 1956.

Estimates of drilling expenditures in the latest survey were based on a sample made up from reports covering 39.7% of productive footage and 24.4% of dry-hole footage in 1955. For 1956, the sample covered 38.8% of productive footage and 22.8% of dry footage.

A high proportion of deeper wells was included in the sample. In most cases, however, reports on shallow wells were adequate to permit making reliable estimates.

Influence of deeper drilling on costs is shown in the sample itself. Replies covered 32.7% of total footage drilled in 1956 but accounted for 42.6% of total expenditures.

An attempt to estimate gas and oil-well costs separately was abandoned because of problems of statistical interpretations. However, examination of sample data showed that gas wells generally cost more than oil wells when drilled in the same area and to the same depth. The difference appeared to be between 5 or 10%.

One interesting apparent contradiction did develop from the study. It shows the average cost of drilling a well is not the same as the cost of drilling an average well.

Average cost of drilling a well in 1956 was $50,200. Cost of the average well was $39,900.

HERALDING new upgraded regular gasolines on West Coast are Union's "7600" and "Mobilgas R".

West Coast Pushing Regular Gasoline

• Switch to upgraded regulars—in the 92-octane range—is cutting in on premium sales. The new trend, with three majors setting the pace, is giving refiners a breathing spell from octane race.

THE OCTANE race on the West Coast is showing signs of switching from premium to regular gasoline.

Marketers and refiners are concentrating more on upgraded regulars, which already have gone on sale at many service stations.

The new regulars—in the 92-octane range—are designed to fill the gap which has existed between regular and premium gasolines.

During the last year, most West Coast refiners came out with premium of 100 octane or more, while their regular stayed below 90. This forced most motorists to either buy a high-priced, high-octane premium their cars really didn't need, or a low-octane regular which wouldn't give peak performance.

The switch . . . Setting the pace in the new trend was Union Oil Co.

Union is advertising its new regular as being capable of satisfying four out of five California cars—at a saving of 4 cents a gallon. Union doesn't advertise the octane rating of its new regular, but it reportedly is 92.

Union had the field to itself for several weeks before General Petroleum Corp. and Tidewater Oil Co. launched their regular-gasoline sales-promotion campaigns.

General Petroleum's new regular is in the 92-octane class. Tidewater's reportedly is over 90.

In its sales pitch, Tidewater is claiming its regular is cleaner burning, while Union and General Petroleum are stressing the money-saving angle.

How it sells . . . Service-station managers report sales of the upgraded regulars are climbing substantially, cutting in on the premium sales.

Some report that premium, which had maintained a sales ratio as high as 70-30 over regular, has dropped down to only a 55-45 advantage. The normal sales ratio on the West Coast is 60-40, with premium the top seller.

Of the three majors currently pushing new regular gasoline sales, only Union raised its price to the motorist.

Union's new regular is selling at the service station for 28.9 cents a gallon, compared to 27.9 cents a gallon for other major company regulars.

General Petroleum raised the tank-wagon price a half cent on its new regular—but didn't hike the price to the motorist.

The switch to regular indicates at least a breather for West Coast refiners in the spiraling octane race.

Coming: Special Report on World Congress

Special news and photographic coverage, plus a special section of technical papers, from the Fifth World Petroleum Congress will be featured in next week's Oil and Gas Journal.

Besides on-the-spot news coverage, the June 8 issue will contain 43 pages of technical information from selected papers on pipelining, exploration, processing, drilling, and production.

Read next week's Journal for a complete picture of important developments and trends reported at the WPC.

U.S. May Resume Offshore Leasing Soon in Louisiana

FEDERAL and state officials in Louisiana cleared the path last week for resumption of federal leasing in offshore Louisiana.

The area under consideration lies in Zone 2, between 3 miles and 10⅓ miles from shore.

Under a 1956 agreement between the Louisiana Mineral Board and U. S. Interior Department, leasing in Zone 2 shall be done jointly by the state and federal agencies until the U. S. Supreme Court settles the offshore boundary dispute.

The reason for the current interest in Zone 2 is that producing wells in Zone 1 are draining acreage in Zone 2.

Prior to a meeting late last week between the Interior's Bureau of Land Management and Louisiana officials, Chairman William G. Helis, Jr., of the Mineral Board said a basic agreement had been worked out on the new leasing.

There was also some talk of a federal lease sale later this year in Zone 3, which lies beyond the 10⅓-mile limit.

Another dispute . . . Meanwhile, the federal and state governments—though seeking to agree on one phase of offshore operations—were in sharp disagreement on another.

Louisiana Atty. Gen. Jack Gremillion filed a lawsuit at Baton Rouge to halt drilling by an operator who has obtained a federal mineral lease on a tract of land already leased by the state.

The tract in question is located at the mouth of the Mississippi River and has been held under a state lease for several years by Shell Oil Co. and The California Co.

The federal Government has leased the 1,500-acre tract to Floyd A. Wallis, New Orleans, and Pelican Producing Co.

The Louisiana District Court of Plaquemines Parish granted the state a temporary restraining order preventing Wallis and Pelican from drilling on the acreage.

The tract, according to Gremillion, is located on both sides of the Mississippi River around Southwest Pass at Burrwood.

"This area is definitely the property of the State of Louisiana," Gremillion said.

"If that isn't part of the land mass of Louisiana, I'll eat it," he said.

watching WASHINGTON

Joe Reilly

• Foreign oil converts a Texan

THE SENATE'S ANTI-DEPLETION bloc has won an important convert.

Sen. Ralph Yarborough, liberal Texas Democrat, has joined forces with his colleagues who want to nibble at the depletion allowance. Unlike most of those in his adopted camp, though, the Texan wants to cut depletion only on foreign production.

An all-out congressional attack on the 27½% rate appears to have little chance to succeed this session. This fact is recognized by senators who are masterminding the attack.

They have watered down their proposals, first, by seeking to reduce depletion rather than abolish it and, second, by trying to cut the rate on a graduated scale which would discriminate against the bigger producers. Both efforts have failed repeatedly.

It was left to the junior senator from Texas to point the way where their attack had the best chance to succeed. Although it's debatable whether his proposal would bring any more revenue to the treasury, Yarborough has pointed out where the depletion principle is most vulnerable.

Yarborough was enticed into the depletion-nibbling camp by Sen. William Proxmire (D-Wis.). Proxmire had just introduced a depletion-cutting bill sponsored by Sen. Paul H. Douglas (D-Ill.) and others. Proxmire was explaining the bill when Yarborough interrupted with a series of questions.

The Texan wanted to know whether the bill applied to both domestic and foreign production.

Proxmire explained that it did. But he said he would be "delighted" to plug what he called the foreign-oil "loophole."

"If the senator from Texas will introduce a bill to do so," he added, "I shall be happy to support it."

"I think it should be plugged," said Yarborough.

Douglas, Proxmire & Co. would be happy to settle for the Yarborough plan this session. It would open the door to future attacks on depletion—attacks which Yarborough himself might not favor.

• Maybe a tax increase isn't needed

THE CURRENT BUSINESS BOOM REDUCES the threat of an increase in the federal gasoline tax.

Because of an unexpected surge in the nation's economy, tax collections in the fiscal year starting July are likely to exceed President Eisenhower's earlier estimate. If the economy holds near its present level, Congress may be able to keep the mammoth highway-building program on schedule without unbalancing Ike's budget and without raising gasoline taxes.

Many Democrats thought Ike was too optimistic last January when he estimated federal receipts for fiscal year 1960 at $77.1 billion.

But now, economists are predicting record corporation profits of about $50 billion this year. That's about $3 billion more than the January estimate. Prospects look favorable for corporation earnings in 1960 equaling or exceeding this year's.

If current estimates prove reliable, the 52% tax on corporate earnings will boost fiscal 1960 revenue by about $1.5 billion over earlier expectations. That's more than sought by Ike in new and increased taxes.

Although the highway trust fund is facing a possible $241 million deficit in fiscal year 1960, the House public works committee has voted out a bill providing for continuation of the stepped-up road program.

The House ways and means committee is expected to follow through with a bill to bolster the highway fund from general revenue. Encouraged by the brighter economic outlook, Democratic leaders are now convinced Ike would find it hard to veto the bill if it leaves his budget in the black.

Mandatory Imports Plan Scheduled for

• Carson lays recommendations before Seaton that would cut flow of imports coming into East Coast and raise West Coast quotas. Carson also releases first results of mandatory plan. They show imports have fallen sharply.

OIL-IMPORT quotas will be reshuffled in the second half of the year to reflect unexpected shifts in the demand pattern.

Capt. Matthew V. Carson, Jr., administrator of the Oil Import Administration, has drawn up voluminous pages in the mandatory control program which he will recommend to Interior Sec. Fred A. Seaton.

Interested parties will be given until June 4 to make comment or suggestion on the proposed changes.

In general, the recommendations are designed to compensate for lower demand anticipated in Districts 1-4 and higher demand now forecast for West Coast District 5.

Principal changes proposed by Carson include:

... **The sliding-scale** formula for establishing individual company quota for imported crude oil and unfinished products would be changed.

In Districts 1-4 quotas have been based on a percentage of refinery runs, ranging from 12% for input up to 10,000 bbl. daily and dropping to 4% for input exceeding 300,000 bbl. daily. In District 5 the scale has ranged from 25% on the first 10,000 bbl. to 6% on input exceeding 200,000 bbl. daily. New percentages haven't been announced, but they are expected to be lowered in Districts 1-4 and raised in District 5.

... **Established importers** in Districts 1-4 would be allowed minimum quotas amounting to 75% of their last crude-oil allocation under the old voluntary program. The "floor" in District 5 will remain at 80%, the minimum level now in effect in both regions.

... **On the West Coast,** individual

Here's What Companies Are Importing . . . barrels per day.

FINISHED PETROLEUM PRODUCTS

(Barrels per day for April)

Districts 1-4

Importer	Residual	Other Products
Asiatic Petroleum	3,025	1,441
Atlantic Refining	825	.....
Ballard Oil Co.	2,168	661
Belcher Oil Co.	1,756	.....
Canadian National Railways	15	.....
Colonial Oil Ind.	1,705	.....
Dept. of Defense	391	30,436
Eastern States	3,436	.....
Ethyl Corp.	.....	1
Hess, Inc.	68,714	2,443
Inland Terminals	40	.....
Metropolitan Petroleum	21,424	3,596
Otto Leonhardt Assoc.	.....	1
Paragon Oil Co.	62,168	1,756
Royal Pet. Corp.	3,625	.....
Shell Oil Co.	5,413	8,152
C. H. Sprague & Son	20,165	.....
Standard of California	3,252	7,365
Standard of Indiana	14,248	.....
Standard of N. J.	91,616	7,607
Standard of Kentucky	17,020	.....
Stuart Petroleum	4,097	.....
Western Sol. & Chem.	.....	15
White Fuel Corp.	11,127	.....
TOTAL	336,230	63,474

District 5

City of Seattle	.....	4
Dept. of Defense	.....	6,504
TOTAL	.....	6,508

Puerto Rico

Dept. of Defense	.....	1,010

FINISHED PRODUCTS (Continued)

Standard of N. J.	1,568	.....
Puerto Rico Iron Works	1,332	.....
TOTAL	2,900	1,010

UNFINISHED OILS

Districts 1-4

Importer	Mar. 1-10	Mar. 11-31	Apr.
Crown Central	.....	2,059	.....
Delhi-Taylor	.....	5,110	.....
Gulf	5,200	.....	10,415
Hess, Inc.	8,800	.....	.....
Socony Mobil	7,500	.....	.....
Southwestern	.....	4,335	.....
Standard of California	27,800	3,941	.....
Standard of Indiana	7,300	.....	7,679
Texaco	24,500	.....	.....
Tidewater	17,800	.....	.....
TOTAL	98,900	15,445	18,094

District 5

Golden Eagle	.....	2,519	.....
Palomar	.....	513	.....
Powerine	.....	4,537	.....
Richfield	.....	2,869	.....
Shell	.....	819	140
Socal Oil & Ref.	.....	1,028	.....
Union	5,100	7,322	1,358
U. S. Oil & Ref.	.....	6,529	2,369
Wilshire	.....	8,828	.....
TOTAL	5,100	34,964	3,867

Puerto Rico

Caribbean Ref.	.....	4,576	2,621
Commonwealth	.....	.....	4,048
TOTAL	.....	4,576	6,669

a Major Overhaul

importers would be allowed to bring in greater volumes of unfinished oils, provided the total imports of unfinished oils in District 5 does not exceed 10% of the combined crude and unfinished quotas.

While preparing to overhaul the quota system, Capt. Carson expressed confidence in the mandatory program. He said it had been "extremely effective" in reducing oil imports.

First figures . . . In releasing the first tabulation of imports under mandatory controls, Capt. Carson said that progress to date "indicates that the national security objectives of the program are being met."

Here are the highlights of his report:

. . . Imports of crude and unfinished oil averaged 819,491 bbl. a day from the beginning of the program on March 11 through April 30. The total represents a reduction of 310,209 bbl. daily from the average of 1,129,700 bbls. a day of crude and unfinished oil which came in during the preceding 8 months.

. . . In April, first month in which import controls were effective on finished petroleum products, imports of residual fuel oil totaled 336,230 bbls. daily in the United States and 2,900 bbl. daily in Puerto Rico. In 1958 imports averaged 347,100 bbls. daily in the United States, and for the last 6 months of 1958 they averaged 2,140 bbl. daily in Puerto Rico.

. . . Finished products came into the United States in April at an average rate of 69,978 bbl. daily compared with 145,300 bbl. daily in 1958. In Puerto Rico they averaged 1,010 bbl. daily in April as compared with 611 bbl. daily in the second half of 1958.

. . . Crude and unfinished oil were imported into Puerto Rico at the rate of 60,901 bbls. daily during the March 11-April 30 period.

Defends formula . . . Carson also defended the policy of using refinery input as a basis for setting company allocations for imported crude oil and unfinished products. Production cutbacks ordered by the Texas Railroad Commission had brought complaints that the formula tended to increase refinery runs, thereby adding to excessive product inventories.

"I think that reasoning is entirely fallacious," Carson said.

He said it "doesn't make sense economically" for a refiner to increase runs by 10,000 bbl. merely to get a 1,200-bbl. higher import quota.

CRUDE-OIL IMPORTS

Districts 1-4

Importer	Mar. 1-10*	Mar. 11-31	Apr.
Allby Asphalt	.....	.....	971
Ashland	.....	.....	8,433
Atlantic	58,600	48,974	35,528
Aurora	.....	5,190	.....
Bay Refining	3,800	3,772	5,184
Cities Service	24,700	38,840	25,286
Clark Oil	.....	.....	4,026
Continental	3,900	3,876	6,161
Cooperative Refinery Assn.	.....	.....	3,300
Cosden	.....	.....	6,936
Crown Central	2,200	.....	6,485
Danaho Refining Co.	500	.....	.....
Delhi-Taylor	.....	5,794	.....
Eastern States	30,400	38,684	3,706
Frontier Refining	.....	.....	4,067
Gabriel	6,700	.....	.....
Great Northern	29,400	30,368	21,346
Gulf	88,400	67,275	51,203
Hess, Inc.	.....	12,217	8,793
Indiana Farm Bur.	.....	.....	2,833
Ingram Oil & Ref.	.....	5,674	.....
International Ref.	16,000	6,251	9,041
Lakehead Pipeline	500	274	238
Leonard Refineries	.....	.....	7,686
Metropolitan Pet.	21,700	5,851	1,195
Murphy Corp.	.....	6,255	6,511
National Coop. Ref. Assn.	.....	.....	4,267
Northwestern Ref.	15,000	11,557	11,596
Ohio Oil	10,800	.....	.....
Petroleum Specialties	.....	.....	2,539
Phillips	25,400	.....	.....
Pure	.....	24,987	13,049
Republic Oil Ref.	.....	5,905	.....
Shell	.....	6,047	15,490
Sinclair Ref.	38,300	45,344	46,680
Socony Mobil	54,400	53,560	38,040
Southland Co.† est.	9,000	.....	.....
Southwestern Oil & Ref.	11,600	7,736	.....
Standard of California	32,400	52,660	36,928
Standard of Indiana	27,100	22,498	29,600
Standard of N. J.	53,000	53,959	67,955
Standard of Ohio	35,300	5,645	.....
Sun	33,400	36,838	20,770
Sunray Mid-Continent	14,100	7,381	4,977
Tennessee Gas	.....	5,281	4,058
Texas Asphalt	2,000	.....	.....
Texaco	66,500	30,196	33,336
Tidewater	60,000	15,453	21,668
United Refrigerator	8,400	4,429	2,987
TOTAL	783,500	668,771	572,869

*Imports under voluntary plan. †Includes Delta Refining Co.

District 5

Importer	Mar. 1-10*	Mar. 11-31	Apr.
Bankline Oil	.....	3,558	.....
Caminol	900	4,000	.....
Century Oil	.....	.....	4,459
Douglas Oil	.....	5,400	591
Edgington Oil	.....	.....	6,272
General Petroleum	42,100	24,585	16,036
Golden Eagle	1,400	.....	4,363
MacMillan	.....	.....	4,641
Palomar	.....	220	.....
Powerine	.....	2,400	.....
Richfield	.....	4,304	10,920
Shell	25,000	29,290	23,804
Socal Oil & Ref.	.....	441	.....
Standard of California	29,900	41,817	38,023
Sunland Ref.	2,100	2,389	.....
Texaco	29,600	10,383	22,616
Tidewater	7,400	27,268	16,467
Union Oil	28,200	1,063	17,809
U. S. Oil & Ref.	.....	.....	.....
Wilshire	35,500	3,785	6,324
TOTAL	202,100	160,903	172,325

Puerto Rico

Caribbean Ref.	.....	14,491	15,450
Commonwealth Oil	.....	43,459	37,645
TOTAL	.....	57,950	53,095

Use of Additives to Keep Increasing

• They'll outstrip the demand for fuels and lubricants into which they're put as quality demands force refiners to employ additives they're not now using. There are already needs for some that are yet to be developed.

ADDITIVES for petroleum products have a bright future.

Markets for these chemicals are even expected to expand faster than consumption of the products to which they are so closely tied.

This is due to new additives now jockeying for position in the consumption pattern and increased use of the old standbys in upgraded motor fuel.

That's the outlook coming from a 2-day meeting of the Commercial Chemical Development Association.

Motor fuels market . . . Consumption of familiar tetraethyl lead should increase by about 10% by 1965.

W. A. Herbst of Esso Research & Engineering Co. predicted the increase would be from 512 million pounds per year to 565 million.

While lead concentration is limited to a maximum of 3 cc per gallon, the weighted average now is about 2.3 cc. The concentration in premium has been running about 2.5 cc, but in regular grades it has declined in recent years to 2.2 cc.

A parallel growth also will be found in the scavenging agents—ethylene dichloride and ethylene dibromide—used in the TEL fluid. Currently about $277 million per year is being spent for motor-fuel antiknock compound and another $38 million for its use in avgas.

TEL supplementary compounds have been in the news recently and will bear watching. These include manganese compounds, mercury compounds, and butyl acetate compounds. Their acceptance naturally will increase consumption of the additives.

Combustion deposit modifiers, such as the phosphorous compounds, also are growing, especially in the premium fuels. About 30% of the gasoline sold on the East Coast includes these in an average concentration of 20 parts per million.

Nearly all premiums are expected soon to use these compounds. Their demand, as a result, is expected to grow from an annual 2.1-million pound figure last year to 2.7 million pounds in 1965. If all the regular-grade gasoline used these compounds, as is possible, the market easily could be three times larger.

Other additives for gasolines include the antirust agents expected to grow from 4.6 million pounds to 5.0 million pounds in 1965; anti-oxidents, up from 7.3 to 8.2 million pounds; and metal deactivators, up from 1.3 to 1.6 million pounds.

Lube additives . . . Use of additives in lube oils continues to increase despite the relatively stable lube-oil market.

The new engine designs, high speeds, and stop-and-go driving will see this trend continue, George L. Weemer, California Research Corp., predicted.

In 1940 additives used in lube oils totaled 40 million pounds per year. Their volume jumped to 170 million pounds in 1945, rose to 560 million in 1955, and this year should reach 680 million pounds.

The breakdown of estimates of lube-oil additives this year is: Conventional detergent-dispersants, 325 million pounds; viscosity index improvers and polymeric detergents, 160 million; oxidation and corrosion inhibitors, 100 million pounds; E. P. additives, 60 million; pour-point depressants, 30 million; and foam inhibitors, dyes, etc., 8 million.

Research needs . . . Much work is still to be done to improve additives for distillate fuels.

J. H. Kirk and H. D. Young, Sinclair Research Laboratories, Inc., in a joint paper noted these research needs as:

. . . Thermal stability. Supersonic jets will need fuels that can withstand temperature levels above 500° F.

This heat will stem partly from high skin temperatures and use of the fuel as a heat sink for cooling lubricants and other components. Additives will be needed to prevent fuel deterioration by coking and formation of gums and sludges.

. . . Moisture control. Freezing of entrained moisture in jet fuels is a big problem.

At high altitudes, the ice formed plugs fuel filters. Coalescing-type fuel filters are being used to eliminate the problem before it ever gets to the plane. But additives possibly could give an assist.

Another moisture-control problem exists with diesel equipment operated below freezing. Alcohol-type fuels have been used, but possibly a miscible, duel-purpose additive could do a better job. With good ignition quality characteristics, the additive could provide freeze-out protection as well as reduce injection pump and nozzle plunger wear.

. . . Freeze-point depressants. Refiners often have difficulty meeting freeze-point requirements of kerosine-type turbine fuels without going to special processing and treating to end-point cutting. An effective ashless-type additive would be desirable to lower freeze point from minus 40° F. to below minus 50° F.

. . . Combustion improvers. More work needs to be done on additives which can be added to jet fuels to promote cleaner combustion, give less smoke, and prevent combustion blow-out at high altitudes.

. . . Antistatic additives. Considerable success has been achieved in developing additives for reducing static hazards in handling jet fuels and allied distillates. Considerably more work in this area is needed.

PROCESSING

Arkansas Louisiana Chemical Corp., subsidiary of Arkansas Louisiana Gas Co., is entering the retail gasoline field and is building its first service station at El Dorado, Ark. Additional locations at Pittsburg and Jefferson, Tex., Shreveport and Bossier City, La., and Little Rock, Russelville, Texarkana and Magnolia, Ark. are being considered. The company operates eight natural-gasoline plants which will supply the service stations.

The name of Derby Refining Co. has been changed to Derby Refining Co. Division of Colorado Oil & Gas Corp. Derby operates a refinery at Wichita, Kans. J. W. Meehan, executive vice president of the old company, has been named president of the Derby Division.

Imperial Oil has awarded the contract for construction of a 1,500-bbl.

"Screw" Pump Moves Heavy or Sandy Crudes

• New Moyno unit is now being field tested, not yet ready for market.

ONE of the world's most unusual pumps, now only in surface use in the oil fields, is undergoing field tests as a down-hole pumping tool.

The pump, the Moyno, was developed by Robbins & Myers, Inc.

The surface model, used by the industry in the field for several years, employs a unique "progressing cavity" pumping principle. It has gained a reputation of being able to pump practically anything—from free-flowing liquids to nonpourable pastes. Abrasive or chemically active fluids or those containing solids in suspension do not faze it.

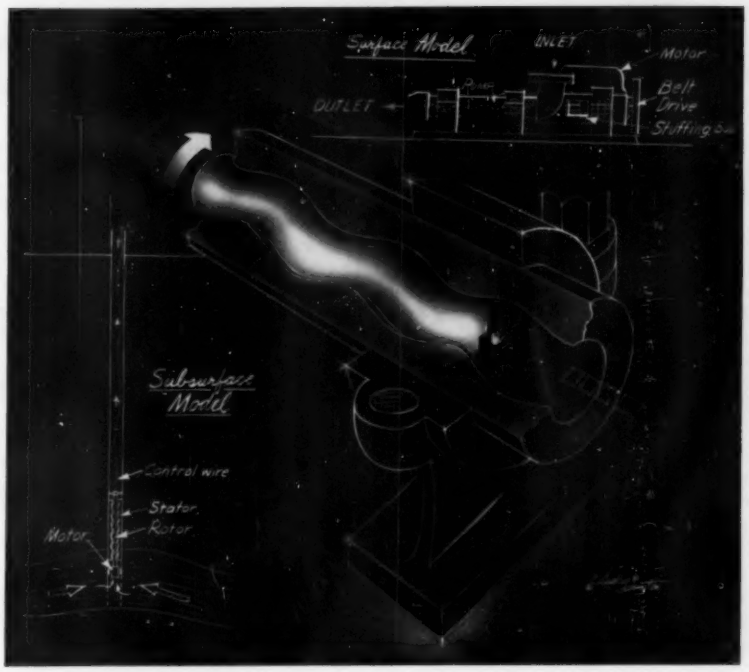
Basically, it consists of a smooth, cork-screw type shaft (or helical screw) and a fixed barrel or stator with a double internal helical thread. The shaft, when turned, pushes "pockets" of fluid progressively through the pump. The rotary motion, however, creates a continuous flow at positive pressure.

One of the most recent surface applications of the pump has been to handle sandy oil produced from the well after fracture treatment.

For down-hole use, the Moyno has been fitted out with a small enclosed down-hole electric motor. It is controlled via a wire to the surface.

Prime applications here would be for pumping highly viscous crude or crude containing sand.

A Robbins & Myers spokesman told the Journal that the pump has performed fairly well in the field tests so far. It will be some time yet, however, before it is offered to the industry, he said.



MOYNO pump may become down-hole tool for oil industry.

BRIEFS . . .

alkylation plant at its Sarnia, Ont., refinery to Canadian Bechtel. Work will get under way in August, with completion scheduled for February 1960.

Triangle Refineries, Houston, has purchased Cotton Valley Solvents, Inc., of Shreveport, La., which operates a 2,000-bbl.-daily refinery producing aliphatic naphthas. No changes in operations or personnel are planned. Triangle is owned by Kerr-McGee Oil Industries.

A new polyethylene plant and a unit to produce vinylidene chloride and chlorothene, to cost $12 million, will be built by Dow Chemical Co.'s Louisiana division at Plaquemine, La. They will be completed in 18 months to 2 years.

A $750,000 expansion is planned of a gas-processing plant in Wise County, Texas, owned by CM&M Gas Products Plant, Inc. The expansion, to be completed in about 6 months, will increase capacity from 100 million cubic feet of raw gas per day to 150 million. Liquid recovery also will be boosted. CM&M is owned 80% by Christie, Mitchell & Mitchell Gas Products Plant and 20% by Warren Petroleum, which is operator.

A 12,000-bbl. catalytic reformer and a 12,000-bbl. hydrotreater are being added to Texaco's Los Angeles Works at Wilmington, Calif. The new units are expected to be on stream by June 1960.

Atlantic Refining has put on stream one of the world's largest paraffin wax plants at its Philadelphia refinery. The $18-million plant will increase Atlantic's wax production 80%. Output will be 165 tons of wax daily by the methyl ethyl ketone solvent dewaxing process.

Also for Refiners . . .

IN THE NEWS: The octane race on the West Coast is now centering on upgrading regular gasoline (p. 92) . . . Carson recommends major overhaul of mandatory imports controls (p. 92) . . . Additives for petroleum products have a bright future (p. 96) . . . Refiners hear news of versatile measuring system and a new computer which will control distillation column at capacity vapor rate (p. 98) . . . Other API refining (pp. 99-100) . . . API recommendations for changing motor oil may be shifted from 1,000 to 2,000 miles (p. 107).

PLUS THESE TECHNICAL REPORTS: Sulfide scaling under hydrofining conditions (p. 117) . . . Processing crude of low pH (p. 121) . . . Optimum use of byproduct hydrogen (p. 129) . . . Guiding refining operations with pilot plants (p. 135).

Refiners Given Electronic Yardstick

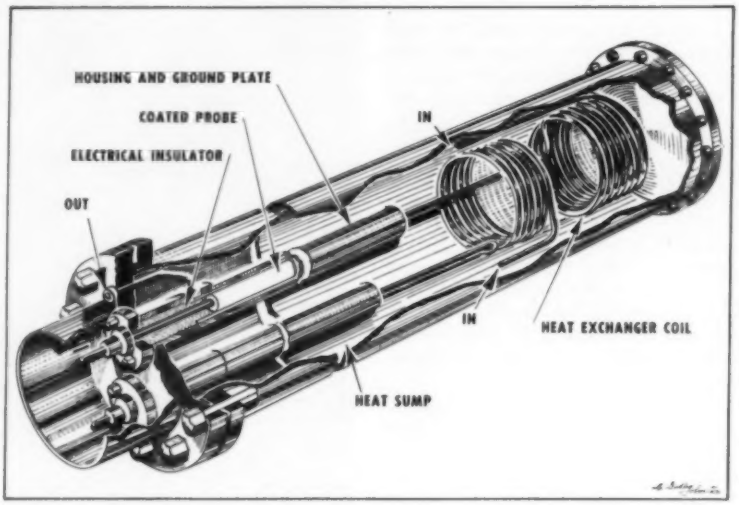
• API meeting told of versatile measuring system and a new computer which will control a distillation column at capacity vapor rate.

A NEW electronic measuring system can be used for a variety of refinery applications.

Sun Oil Co. refineries use the device for level measurement or control of hot liquids, granular materials, very cold liquids, and corrosive liquids. Measurements can be made under difficult conditions where the absence of moving parts in the measuring system is desired. The device is compensated for effects of temperature change.

The same system is also used for stream analysis. And it is used to measure moisture in liquid hydrocarbon streams in the parts-per-million range.

This instrument and its uses were described by E. N. Shawhan, Sun Oil, at the API midyear refining meeting in New York last week.



MEASURING system shown adapted for a stream analyzer.

Two major parts . . . The device, which basically measures electrical capacity, actually consists of two separate units.

A rugged transmitter is mounted near the point of measurement. The remainder of the circuit, with the zero and span adjustments, may be mounted in a convenient location. The system is independent of the characteristics of the cable joining the two units.

The system has evolved as the result of field experience with particular attention to installation and maintenance considerations. This experience has extended over several years in a variety of applications, Shawhan said.

The electronic portion of the system is standard with flexible adjustments for a variety of problems. The capacity-sensing probes are similar for each type of application.

Level measurement . . . Capacity measurement can solve many difficult level-indication or control problems.

The electronic portion of the system can be made standard by giving the zero and span adjustments enough range to cover the variety of materials and geometry encountered. Design of the measurement probe, however, changes with the situation, he said.

Capacity-level measurement depends upon a condenser with a vertical rod, insulated from ground, as one plate. The vessel wall or metal cylinder connected to it is the other plate, and the material in the vessel is the dielectric of the condenser. The capacity of the condenser varies with the length of the probe covered by the material which has a higher dielectric constant than the air or vapor which it displaces.

Usually enough free water is present to short out a bare probe. Therefore, all areas vulnerable to water must be coated with insulating material which is not readily wetted with water. Depending on temperature, materials such as Hypalon, Teflon, or quartz may be used for this purpose, he said.

Stream analysis . . . Changes in stream composition can be detected from changes in dielectric constant.

And if the change is caused principally by one component in a complex stream, or the ratio of two components, the analysis can be made quantitative, Shawhan said.

The capacity unit contains two identical cells (see sketch above). One cell is filled with a typical sample of the material to be measured and closed off, or a reference stream is passed through it. This cell serves as the remote reference condenser.

A filtered and dried sample stream is allowed to flow through the other cell. Variations in dielectric constant of the sample stream from that of the material in the reference cell change the measured capacity difference. Both cells are immersed in a constant-temperature bath to keep them at the same temperature, he said.

Moisture measurement . . . Capacity measurement is a convenient method of monitoring performance of a dryer case.

An insulated probe is buried in the desiccant. As the desiccant absorbs moisture, its dielectric constant increases.

A record of the capacity of the probe indicates when the dryer ceases to be effective and permits the maximum on-stream time. The moisture in a liquid hydrocarbon stream can be measured down to about 5 ppm. by a simple capacity measurement, Shawhan said.

Computer control of columns . . . A special analog computer can control a refinery distillation column to capacity vapor rate economically and reliably, according to W. O. Webber, Humble Oil & Refining Co., Baytown, Tex.

The computer determines the actual vapor rate from measured reflux and product rates, the vapor capacity at any given pressure, and finally the per cent of vapor capacity actually being utilized. This latter figure is recorded and can be used to control the tower to any desired percentage of capacity, he said.

The computer is a special purpose

unit which uses magnetic amplifiers, diodes, and transistors. No tubes or moving parts are used.

Closed-loop control is attained in that the output signal from the computer positions the set point on the reflux rate-of-flow controller. Thus, when vapor capacity is the point of limitation, as it is in many distillation towers, tower operation is actually optimized, he said.

Tests have been carried out over a period of several months on a 14-ft., 50-plate tower which cuts hexanes and lighter overhead from a desulfurized light naphtha. These tests have shown:

... **Good reliability,** accuracy, and service factor can be achieved.

... **Good acceptance** by the operators resulted. Because of better operation, the computer has served as a morale booster.

... **Customized computer control** can be achieved in 18 months for less than $10,000.

The increase in vapor rate which can be obtained by using the computer on a $500,000 distillation column can conservatively be estimated to be worth $5,000 annually. This means that the computer can pay itself out in 2 years or less, Webber said.

Nalfining: New Way to Upgrade Distillates

ACETIC ANHYDRIDE provides a new route to upgrading petroleum distillates.

Its use in the Nalfining process eliminates odors, reduces sludge formation and corrosion, and improves stability.

That's the report from Nalco Chemical Co., which revealed aspects of the process at the API Division of Refining meeting last week in New York.

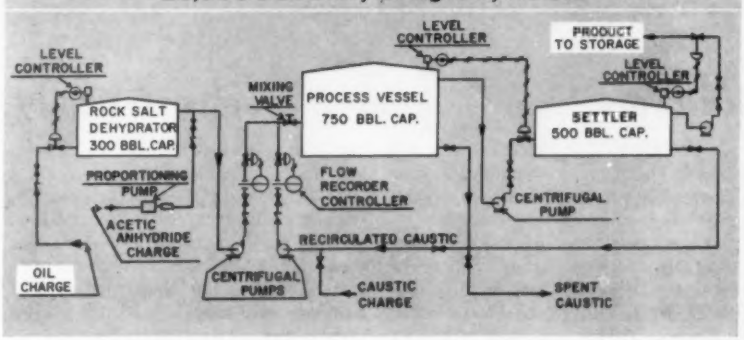
The report noted the low-cost Nalfining process particularly is applicable to upgrading light fractions. These include heating oil, diesel fuel, kerosine, gasoline, jet fuels, and solvents.

This is accomplished by inactivating unstable, reactive contaminants, such as sulfur, nitrogen, and complex organic compounds present in the stocks. These constitute a problem that has been expensive and frequently impossible to solve with other processes.

Difficulties normally experienced in using the distillates include odors in solvents, color instability, sludge formation, and filter plugging in home-heating oil and diesel oil, and corrosion and instability in jet fuels.

Nalfining reportedly combats the contaminants by converting them into innocuous reaction products. It does not necessarily reduce the total sulfur or nitrogen content of a distillate stock, but it does handle effectively such troublemakers as the pyrolles. These are nitrogen-containing compounds which don't respond well to conventional treating methods.

NALFINING flow diagram of an installation processing 20,000 bbl. daily of light cycle oil.



Expensive installation is not necessary for the process, according to Nalco engineers. Process vessels and treating tanks available from caustic or acid-treating operations can be adapted. Aluminum storage, tanks, pumps and lines to handle acetic anhydride are normally the only new equipment required. The process is followed by a caustic wash.

Chemical costs for solvent deodorizing can run as low as 3 mills per barrel of stock processed, the engineers stated. Relatively sour streams of gasoline or light cycle oil might require costs as high as 3½ to 5 cents per barrel.

Octane Rating of Blends Now Predictable

THREE scientists in Ethyl Corp. research laboratories have come up with an answer to the costly, time-consuming, and tricky job of determining the octane number of gasoline blends.

Formulas developed by W. C. Healey, Jr., C. W. Maassen, and R. T. Peterson permit direct calculation of blend research and motor octane numbers at tetraethyl lead concentrations of 3, 1.2, and 0.0 ml. per gallon.

What the researchers faced was this: When fuel components are blended, the octane number of the blend may be greater than, equal to, or less than the volumetric average octane number of the components.

The deviation from volumetric average may be as much as several octane numbers. With the increasing cost of octane improvement, prediction of this deviation can be economically important.

What they did . . . The researchers had to consider two principal reasons for the blending deviations:

... **Varying effect** of hydrocarbon type and concentration on combustion reactions.

... **Uncertain effect** of rating the blend of components at different compression ratios and different engine conditions. Usually an octane number is valid only when used at the engine conditions at which it was determined.

These considerations and other re-

quirements were the basis for selecting certain functions of common fuel properties for use in predicting blending deviations.

Formulas were then developed on 75 blends and checked on an additional 60 blends at three different TEL levels. The number of components varied from 2 to 15. The formulas contained functions based on octane number sensitivity and hydrocarbon type.

They permit direct calculation of octane numbers at the three TEL concentrations. Blend octane numbers at other TEL concentrations can be determined on a TEL susceptibility chart. The accuracy of the formulas, the authors hold, is reasonably good as compared to that of ASTM antiknock rating.

Fast figuring . . . The necessary calculations can be performed on either desk calculators or high-speed computers.

By following an IBM-704 Fortran program, prepared by the authors, it is possible to calculate the research and motor-octane number of a blend containing 10 components in approximately 2 seconds.

How good are the formulas? At 3.0 ml. TEL per gal., the standard error for research method is 0.56 octane number for the blends from which the formulas were derived, 0.67 octane numbers for check blends from the same sources and 0.68 octane numbers for check blends from independent sources.

The authors believe the formulas will be useful both for operating and economic calculations in a specific refinery and also for industry-wide studies.

Reformer Feeds Treated Electrostatically

NEW DEVELOPMENTS in electrostatic desulfurization indicate that this treating process is economical for pretreating reformer feed stocks.

The process may be used also to desulfurize such stocks as vis-breaker gasolines, kerosines, and middle distillates, R. J. Phillips, of Howe-Baker Engineers, Tyler, Tex., told the API refining meeting.

In the process sulfuric acid of almost any concentration is added directly to the feed stock. Then, following electrostatic mixing, the treated oil is mixed with weak caustic. Final step consists of water washing to remove last traces of caustic, he said.

Sulfur removal is as high as 95%, with arsenic, lead and nitrogen compounds being removed also. Treating losses are less than 0.5% with straight-run naphthas, but they increase for heavier feed stocks and those containing unsaturates.

Installed cost of a 10,000-bbl. per day unit should not exceed $350,000. If fresh acid is used, total operating costs are about $0.079 per bbl. If spent alkylation acid is available, operating costs can be cut to $0.048 per bbl.

Ohio, Aurora Merge

. . . in stock deal. Aurora to operate as subsidiary.

FINANCIAL details are being completed for merger of Aurora Gasoline Co., Detroit, into Ohio Oil Co.

Ohio President J. C. Donnell II said that subject to working out details Ohio will acquire the Aurora capital stock in exchange for 875,000 shares of Ohio Oil.

"Aurora will operate as a wholly-owned subsidiary of the Ohio Oil Co.," Donnell said. "Present management will carry on the policies which have proved so successful in the development of Aurora. Retail and wholesale marketing operations will continue in the same manner, with retail sales continuing under the 'Speedway 79' brand name."

Aurora, privately owned, is Michigan's largest independent refiner and marketer. It has been an important crude-oil customer of Ohio for many years. Aurora has refining capacity of about 65,000 bbl. daily in its principal refinery at Detroit and smaller plants at Muskegon and Elsie, Mich. Its subsidiary is Speedway Petroleum Corp. which markets through 660 service stations of which nearly 400 are in the Detroit area. Ohio markets under the Marathon brand in Illinois, Indiana, Ohio, Michigan, Kentucky, and Wisconsin.

The deal will more than double Ohio Oil's refining capacity. The company currently has only one refinery, a 50,000-bbl. plant at Robinson, Ill.

the JOURNAL *said . . .*

50 *years ago*

June 6, 1909

Newly formed Lone Star Gas Co. gets Texas charter and announces plans for 16-in. gas line from Clay County fields to Fort Worth, a distance of 100 miles.

A group of Standard Oil Co. officials headed by John D. Rockefeller, Jr., tours Oklahoma and Kansas oil fields on Rockefeller's first visit in this region. The group is traveling in a special train.

Pig's Ear, a small, dingy cafe frequented by nearly every oil man coming to Tulsa and famous for its good food, is being torn down. Its owners, Bert Center and his wife, will build a modern hotel on the site, on Main Street just north of the Frisco tracks.

Newly reduced freight rates on shipments of Oklahoma crude to Texas and Louisiana for fuel use are having a depressing influence on the Gulf Coast market. Shortage of freight cars to move the cheaper Oklahoma crude may stall a major price break.

25 *years ago*

May 31, 1934

First submersible drilling barge finds successful use in maritime operations of The Texas Co. at Lake Barre, in Terrebonne Parish, Louisiana Gulf Coast.

Shell Oil Co. opens Roanoke fields in Jefferson Davis Parish, Louisiana, with deepest production on Gulf Coast. Its 1 Kratzer discovery well flows 1,035 bbl. daily through 18/64-in. choke from 8,600-ft. sand.

Huge herd of wild elephants invades Djambi District, Sumatra, Netherlands Indies' most important oil operation, causing extensive damage to oil company properties.

HEADLINES: U. S. Senate approves oil production control bill . . . Water flooding in eastern fields increases oil recovery and extends life of production . . . New California market agreement brightens Pacific Coast oil outlook . . . Long extension of Montana's Cut bank field indicates productive area 30 miles long.

10 *years ago*

June 2, 1949

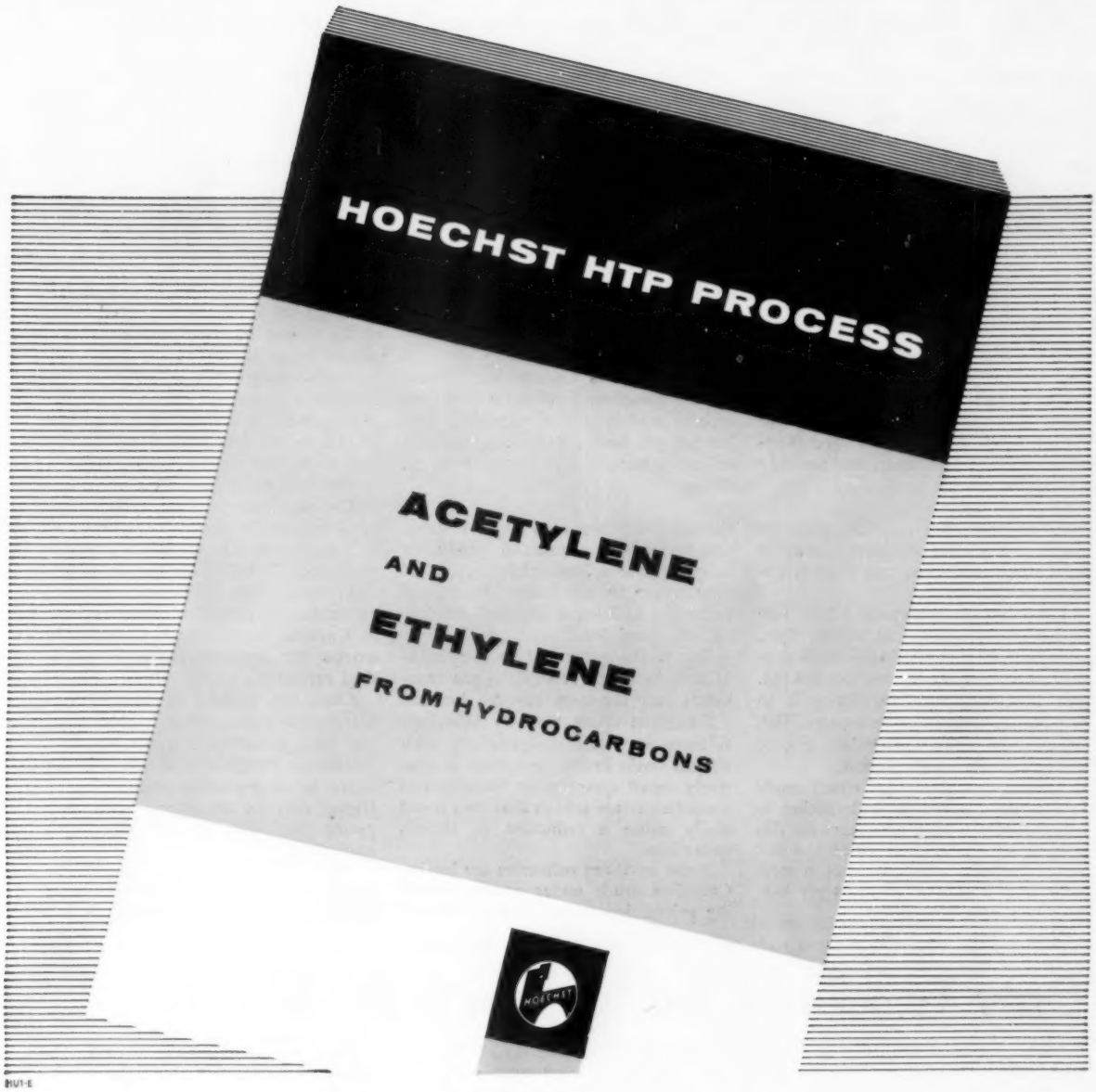
Imperial Oil, Ltd., reveals plan for crude pipe line from Edmonton and Alberta oil fields to terminal on Great Lakes to supply eastern Canadian refineries directly, or by trading with United States.

Robert W. McDowell, executive vice president, is elected president of Mid-Continent Petroleum Corp.

Argentine government oil agency reports discovery of oil on the eastern part of Tierra del Fuego.

Former Danciger Oil & Refining Co. refinery at Longview, East Texas, acquired by Rasiom, Italian oil agency, and being shipped to Sicily. Relocated plant, with daily crude capacity of 10,000 to 11,000 bbl. will be first on island.

HEADLINES: Ground broken for Transcontinental Gas Pipe Line Co.'s 1,840-mile, 30-in. gas line from Texas-Louisiana Gulf Coast to New York . . . Pure Oil Co. sells oil properties in Mexia field.



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FIFTH WORLD
PETROLEUM CONGRESS EXPOSITION
June 1 – 5, 1959

Canadian Deal Threatens U.S. Prices

• Contracts for 10,000 bbl. a day of southern Saskatchewan crude being sought at 35 cents or more under the market. If the plan succeeds, crude-oil buyers fear it could shave crude-oil prices in wide areas of the U.S.

A TINY LEAK in the dike which could start a flood of crude-price cutting has started along the U. S.-Canadian border in southeastern Saskatchewan.

Involved are Weyburn and Midale fields, which produce a medium-gravity crude and which are largely shut in for lack of a market. Now producers there are being offered a market in U. S. and Canadian refineries if they will accept a price cut of 35 or 40 cents per barrel.

The crude-oil price structure in both countries is so precarious now that crude buyers fear a local price cut could start a chain reaction that would cut prices in the Illinois basin, Wyoming, the Mid-Continent, and possibly in Alberta.

What's involved . . . The situation hinges on a deal between Canadian Oil Companies, Ltd., and Gibson Petroleum Co., Ltd.

Canadian Oil will spend $2,000,000 to modify its refinery at Sarnia, Ont., to handle Weyburn-Midale crude provided it can obtain at least 10,000 bbl. per day at a price permitting it to pay out its investment in 3 years. This would total about 11,000,000 bbl. of crude over the 3-year period.

Gibson Petroleum, a Calgary crude buyer and trucker, is undertaking to make contracts with producers for this volume of crude. The price has not been disclosed officially, but reports are that it is at least 35 cents per barrel below present postings.

Gibson also is reported offering additional Weyburn-Midale crude at a similar discount to refiners in Minnesota and Michigan. It is also reported to be negotiating with a Montreal refiner to take this crude by Great Lakes tanker.

The producing area is served by the 12-in. Westspur pipeline, which feeds into the Interprovincial trunk pipeline and so could reach Duluth, Minneapolis-St. Paul, and most Michigan refineries as well as the Sarnia-Toronto refining areas.

To date, it is understood, Gibson has completed no contracts except that with Canadian Oil Companies, and has not yet been able to contract sufficient crude at the lower price to do so.

Reason for worry . . . Several major companies are substantial producers in southeastern Saskatchewan, and if they refuse to sell below the posted price the additional negotiations may fail to materialize.

But if the price cut in Weyburn-Midale becomes general, crude marketers fear the dam may be broken.

Canadian crude used by Michigan refiners is priced competitively with Illinois basin crude, and even a relatively small quantity of lower-priced Canadian crude sold in that area could easily cause a reduction in Illinois quotations.

Some northern refineries are buying Canadian crude under contracts having prices tied to the cost of Oregon basin (Wyoming), crude delivered to Chicago.

Thus a break in the price of Canadian crude could be reflected in lower postings in the Rockies as quickly as in Illinois. And since Mid-Continent crude must be competitive with other crudes in the Great Lakes region, its price, too, would be shaky.

The oil in question . . . Midale crude has a gravity of 28° and a posted price of $1.97 per barrel. Weyburn crude ranges from 31° to 34° gravity, and its posting ranges from $2.03 to $2.10. Both have about 2% sulfur.

The two fields embrace more than 30,000 acres, have some 600 wells, and about half the wells have MER's of 100 to 200 bbl. per day.

The area has not been fully developed because of lack of market outlet. Last year the two fields together produced 23,000 bbl. per day.

The Canadian Oil-Gibson deal "at an undisclosed discount" was hailed in Canada as opening an additional market for domestic crude in Canadian refineries.

Crude-oil traders in the United States view it in a different light. They say that if northern refineries take 20,000 or 30,000 bbl. at 35 cents per barrel below prevailing prices, it could trigger cuts for all other crudes competing for the Great Lakes area market.

They are anxiously watching to see how many southeastern Saskatchewan producers accept the lower price.

Only Two Firms Bid for Tracts Off Florida

THE FEDERAL Government's lease sale for offshore Florida was something less than sensational.

But two major companies, bidding jointly on 22 tracts, offered to risk $1,711,872 that oil can be found in the rank wildcat area west of the Marquesas Keys.

The California Co. and Gulf Oil Corp. were the only companies to submit offers at the Bureau of Land Management in New Orleans. Of the 80 tracts offered, Calco and Gulf bid jointly on 22, while Calco bid alone on one more.

Their bids averaged $12.92 per acre for the 132,480 acres contained in the 23 tracts. Since the minimum acceptable bid was $10 per acre, it was evident that Calco and Gulf are not overly optimistic about the area's chances of producing oil.

However, the two companies have done considerable seismic work in offshore Florida, and both have gambled considerably in the past with drilling. Gulf currently has a tight hole drilling east of the tracts offered in last week's sale (OGJ, Mar. 30, p. 98).

Each of the tracts contained the standard 5,760 acres. The bids ranged from a high of $93,139.20 to a low of $58,233.60 per tract, for an average per acre of $16.17 to $10.11.

The BLM took the bonus bids under advisement and is expected to decide this week whether to accept or reject them. If the leases are awarded, the two companies are expected to name an operator and probably drill a well before the end of the year. The 5-year leases do not, however, have any drilling requirements.

Creole Petroleum Corporation of Venezuela, one of the world's largest producers of crude oil, has pursued a dedicated course of conservation and maximum utilization of Venezuela's natural resources. In so doing, complex engineering problems in gas injection have been created.

An organization of the magnitude of Creole can readily command the very best engineering and construction talent available . . . and Brown & Root felt signally honored when in 1952 they were awarded a contract to design and construct a 60,000 horsepower gas injection station, to be located 7 miles from shore in Lake Maracaibo. The job was loaded with "firsts" and superlatives. For example, it was the first time centrifugal compressors were ever used to compress gas to 2000 p.s.i. This tremendous amount of horsepower was to be housed on a platform in 62 feet of water, with all the related problems of vibration, corrosion, noise and self-containment.

Evidence that the client was pleased with this $20 million project came when Brown & Root was awarded a contract to design and construct Conservation Plant Tía Juana Two of 84,000 horsepower, and then again Brown & Root was successful in obtaining the design and construction contracts for Tía Juana Plant Three of 98,000 horsepower. Conservation Plant Bachaquero One, Creole's fourth repressuring station, is currently on Brown & Root's drawing boards.

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Trunkline Expansion Plan Is Approved

• FPC overrules a presiding examiner in a split decision which authorizes company to pay 20 and 22 cents for Texas and Louisiana gas.

THE Federal Power Commission has overruled one of its presiding examiners in approving an $81,458,000 expansion by Trunkline Gas Co. and in raising the price ceiling for Texas onshore gas.

The expansion will permit the Houston pipeline company to deliver 135,000,000 cu. ft. of gas per day to two new customers in Michigan.

Trunkline's project will involve about 895 miles of pipeline, including looping along its main line and a 204-mile extension from Tuscola, Ill., to the Michigan-Indiana border near White Pigeon, Mich.

In a split decision, the commission also approved 13 applications by eight independent producers for sales of natural gas to Trunkline in Texas and Louisiana.

Record price? . . . Trunkline will pay 20 cents per M.c.f. for gas produced in Brazoria and Galveston counties, Texas.

The Louisiana gas, authorized to be sold at the contracted price of 22 cents per M.c.f., will come from Vermilion parish and from Gulf of Mexico fields off Vermilion and Cameron parishes.

The FPC noted that it previously had authorized sales in Louisiana at 22 cents per M.c.f. but that the 20-cent rate may establish a new high for Texas.

FPC records indicate that the initial price set for the Texas gas is higher than any previously approved by the commission for gas produced on the Texas mainland for interstate commerce. It may be the highest ever set by the commission for Texas gas, either onshore or offshore.

A majority of the commission held that Examiner Francis L. Hall had erred in denying approval of the producer applications. There was no evidence, the opinion said, that Trunkline could have contracted for the gas at a lower price.

Vice Chairman William R. Connole dissented to the portion of the order granting producer certificates. He indicated he would have denied them outright or approved them only on condition that the rate be lowered.

Connole said he was "completely unable" to justify a price of more than 17.5 cents for the Texas gas. He also favored lower prices for the Louisiana gas.

The commission majority noted that the contracts for Texas gas provide a firm price for 10 years. Without this, the majority indicated, the certificates might have been conditioned to a rate of 19.5 cents.

The FPC also held that Examiner Hall erred in denying Trunkline's application after he found that the market, gas supply, and facilities were adequate, that the estimated cost was reasonable, and that the project was economically feasible.

There was no justification, the commission ruled, for Hall's conclusion that the project should be rejected simply because Trunkline proposed to use its increased capacity to serve only one or two new customers.

New rates required . . . As approved, Trunkline's certificate requires the filing of revised rate schedules. Effect would be to reduce the price to distributors from an average of 45.75 cents to about 40 cents per M.c.f., based on a 100% load factor.

The expansion program will boost capacity of the Trunkline system from 375,000,000 cu. ft. daily to 510,000,000 cu. ft.

Consumers Power Co., Jackson, Mich., is to take 129,000,000 cu. ft. per day. The remaining 6,000,000 cu. ft. will go to Michigan Gas Utilities Co., Coldwater, Mich.

Arkansas Fuel Is Prize in SEC Bidding

GENERAL American Oil Co. of Texas last week offered to pay more than $152,000,000 for one of the nation's old-line oil companies, Arkansas Fuel Oil Corp.

Under its offer, General American would absorb Arkansas Fuel's physical properties and liquidate the company after paying off stockholders.

The bid was made during oral arguments before the Securities and Exchange Commission. It was opposed by Cities Service Co., which owns 51.5% of Arkansas Fuel's outstanding shares.

Cities Service is under a 1957 SEC directive either to sell its shares or eliminate the minority shares.

Offers clash . . . The General American bid conflicts with an offer already made by Cities Service to acquire all publicly held Arkansas stock. It appears, however, to be more attractive to holders of this stock.

The rub is that General American's offer concerns all stock in the company, including that of Cities Service—and the latter doesn't want to sell unless it must. There are now 3,801,536 shares of Arkansas Fuel outstanding. Of these, 1,843,745 are publicly owned and the rest held by Cities Service. General American is offering $40 a share for all the stock for a total bid of $152,061,440.

This would break down to a bid of $73,749,800 for the publicly owned Arkansas stock.

Cities Service recently offered to acquire this stock via an exchange of one share of Cities Service for 2.4 shares of Arkansas Fuel Oil. Cities Service stock as of midweek was listed at $57 a share. At current market quotations, then, the Arkansas Fuel Oil minority interests would get Cities Service stock valued at about $43,790,000.

What's at stake . . . A prize plum is the object of the Cities Service-General American tug-o-war.

The winner would get full ownership of Arkansas Fuel Oil properties covering:

. . . Production of 11,357 bbl. daily in crude and condensate, 66 billion cubic feet of gas yearly, and 78 million gallons of LPG yearly.

. . . Pipelines totaling 600 miles.

. . . Marketing facilities including 5,722 service stations, 452 bulk stations, 25 pipeline terminals, and 22 water terminals.

. . . Large reserves of 147,097,993 bbl. of oil and 686 billion cubic feet of gas. Company has 1,169 net oil wells and 101 net gas wells.

Are you feeding your refinery DOLLARS . . . and getting PENNIES back in return?

Leading oil economists declare that any processing unit as much as ten years old is probably costing you money.

EXAMPLE:

Most older units utilize furnaces and heaters with only 50% thermal efficiency. Today, good design and economics dictate at least 75% efficiency.

EXAMPLE:

A ten-year-old cat cracker may require up to one-half more operating personnel than a modern unit.

EXAMPLE:

Most crude units built ten years ago needed to be shut down every six months. Modern design often permits operations of twice that length.

If outdated units are eating up your profits, talk with a Treco man about replacing or revamping them. And remember . . . equipment costs are lower today than you can expect for years to come. There has never been a better time to modernize.

Licensing agreements permit Treco to furnish just about any modern processes available. Although we frequently handle process design on a custom basis we own no patented processes and manufacture no refinery equipment. This leaves us free to recommend and use whatever best fits your requirements.

....talk with the TRECO man.....

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Pipeline Divorcement Issue Revived

• Members of House subcommittee are split on recommendations growing out of consent-decree study. Republican minority says divorcement "may ultimately be necessary," but not before a thorough review is made.

A HOUSE subcommittee last week revived the threat of congressional action to divorce oil pipelines from integrated companies.

In a delayed report on a 1957 investigation of consent decrees, Democrats and Republicans clashed bitterly over the Justice Department's enforcement of the 1941 decree limiting dividends which may be paid to shipper-owners of oil lines.

The 305-page majority report, approved by four of the six Democrats on the subcommittee, urged introduction of legislation to eliminate "rebates" from pipeline operations of major oil companies.

Ownership of oil pipelines, the majority report charged, "continues to afford their major integrated owners substantial advantages over the other segments of the petroleum industry."

"In order to correct this condition," the report continues, "the committee recommends that Congress consider legislation that would amend the Elkins Act so as to prohibit expressly any payment of dividends by oil pipelines to their shipper-owners that are derived from transportation charges paid by the shipper-owner, or by competitors of the shipper-owner. Elimination of rebates by the oil pipelines in this manner would reduce the competitive advantages now enjoyed by the major integrated oil companies."

In a strongly worded minority report, three Republican members vigorously defended the administration's handling of consent decrees. The recommendation for tougher legislation to limit pipeline dividends, the Republicans said, "can hardly be germane to an inquiry into the effectiveness of the consent-decree program."

Why divorcement . . . However, it was left up to the Republican minority to suggest what the Democrats had carefully avoided—pipeline divorcement.

Practically speaking, said the Republicans, enactment of the dividend-control legislation "will force divorcement of oil pipelines from shipper-owners." They continued:

"It is conceivable that such measure may ultimately be necessary in order to insure competition in the oil industry. However, such measures should not be lightly considered and certainly not until there has been a thorough and pertinent study of the subject."

J. L. Burke
. . . report has "obvious distortions."

The minority also pointed out that the Justice Department's antitrust division "has not been unmindful of this problem which is currently under investigation and was given considerable study in the attorney general's second oil compact report."

Subscribing to the majority report were Chairman Emanuel Celler of New York and three fellow Democrats—Peter W. Rodino, Jr., of New Jersey, Lester Holtzman of New York, and Herman Toll of Pennsylvania. Two Democrats—Harold D. Donohue of Massachusetts and Byron G. Rogers of Colorado—did not sign either.

The minority views were expressed by all three Republican members of the subcommittee. They are William M. McCulloch of Ohio, William E. Miller of New York, and George Meader of Michigan.

Sen. Kenneth B. Keating (R-N. Y.), who at the time of the hearings was ranking Republican member of the parent committee on judiciary, issued a separate statement challenging the majority report. He charged that the findings were based on "half-truths, deliberate omissions, and biased assertions."

Industry's reply . . . Industry spokesmen also were quick to challenge the majority report.

J. L. Burke, president of Service Pipe Line Co., pointed out that most of the nation's oil pipelines have operated under the Elkins Act consent decree since 1941. This makes unlawful any dividend payments to shipper-

PIPELINE BRIEFS . . .

A new company, Curran & Co., Great Falls, Mont., has been organized by Michael Curran to build oil, gas, and water pipelines. Curran formerly was president of M. J. Crose Manufacturing Co., Tulsa, and a senior vice president of Williams Brothers Co.

In a move to eliminate uneconomical, overlapping service, Kerr-McGee Oil Industries, Inc., and Service Pipe Line Co. will exchange crude-gathering systems in Seminole, Pottawatomie, and Creek counties, Oklahoma. Service will transfer to Kermac some 52 miles of 2, 3, 4, 6, and 8-in. lines serving 102 leases producing 1,180 bbl. daily. Kermac will transfer to Service 38 miles of 2, 2½, 3, 4, 6, and 8-in. lines serving 107 leases producing 1,100 bbl. daily.

The exchange will enable both companies to reduce operating losses without curtailing service. They will be able to salvage pipe idled by the deal.

An airport pipeline will be built by Badger Pipe Line at O'Hara air field near Des Plaines, Ill., just northwest of Chicago. The 2½-mile lateral will connect the airport to Badger's main products line between Chicago and Madison, Wis. The Badger line will be one of the first such jet-age projects in the nation, with others at Miami and Dallas. Badger is owned by Cities Service, Sinclair, Texaco, and Pure.

Spending totaling $114,700,000 during 1959 is budgeted by natural-

owners exceeding 7% of the value of a pipeline's facilities.

Burke said many of the report's conclusions relate to subjects "on which there is no testimony or evidence whatsoever in the record."

"The report should carry little weight as far as it involves the oil pipeline consent decree," he said, "because of its obvious distortions of the evidence and the erroneous conclusions reached."

Burke noted that Service Pipe Line's records as to compliance with the consent decree had been thoroughly checked by the Federal Bureau of Investigation twice in recent years without any resulting complaint or criticism."

"The company has nothing to hide and if the Government wants still another audit, our accounts and records are available to its representatives as they have always been," Burke said, "but we see no justification whatsoever for the time and trouble involved."

Gordon C. Locke, general counsel for the Committee for Oil Pipelines, said the report "seems to be an effort to support preconceptions and prejudices about pipelines and the oil industry."

"Assaulting a key industry to prove any kind of point—political or economic—has a smear touch to it unless backed with sound knowledge and competent investigation, and the Celler committee report appears sadly lacking in both," he said.

The subcommittee made several other sweeping charges that industry spokesmen said were not supported by the record.

2,000-Mile Oil Change Asked

. . . by API committee as an industry standard to put an end to motorists' confusion arising from conflicting advice.

ADOPTION of a "more realistic and uniform oil-change interval" was urged last week by an API advisory group.

It suggested a 2,000-mile or 60-day summer standard and a 2,000-mile or 30-day winter standard. It recommended adoption of the proposal by the API general committee. It also:

. . . **Urged junking** of its own 1,000-mile change policy, in effect with variations for many years.

. . . **Decried the confusion** to which motorists are subjected by conflicting proposals of car manufacturers, dealers, garage owners, service-station operators and organizations.

. . . **Asked for $15,000** to survey consumers to find out to what degree they are influenced in selecting a new car by the makers' oil change recommendations.

Willard W. Wright, Philadelphia, Sun Oil Co., chairman of the API Division of Marketing's advisory group on oil-drain practices, said the new standard should "eliminate confusion, give adequate lubrication under all conditions, more closely approach car manufacturers' recommendations, be consistent with car-dealer recommendations, and be inexpensive insurance of good lubrication for the motorist."

Wright reported the API proposal has been presented to sales, service, and engineering department management of Mercury, Edsel, Lincoln, Ford, Buick, Oldsmobile, Chevrolet, and Chrysler Corp.

"All the manufacturers agreed there is too much confusion resulting from the variety of oil-drain recommendations," he said.

"All except Ford agree it will be desirable to have a simplified recommendation more easily understood and merchandised."

He said Ford believes its promotion of economy, including the 4,000-mile oil drain, has helped in 1959 new car sales. The Ford engineering department also has tested and backed up the 4,000-mile interval as satisfactory for most conditions.

The other manufacturers, Wright said, have agreed to consider the oil-drain proposal in making future changes in their own recommendations. Most groups believe a gradual narrowing of the difference between manufacturer and oil-company recommendations is possible and desirable.

The API found in its own survey of dealers that most dealers:

. . . **Do not adhere** to their manufacturers' oil-drain recommendations but tend toward a shorter interval.

. . . **Would prefer** a uniform oil-change standard.

. . . **Do not consider** long oil-change periods important in selling new cars.

---

gas utility companies in Canada, according to the Canadian Gas Association. Trans-Canada Pipe Lines, Ltd., will spend $13,500,000 on four new compressor stations and 15 metering stations.

Engelking & James, Ltd., Calgary, is building 55.1 miles of laterals for the Alberta Gas Trunk Line. The job is due for completion by September 30. Work to be done includes installation of 21.1 miles of 6-in. lateral in the Wayne, Makepiece, and Chancellor areas; 6 miles of 8-in. in the Consort area; and 28 miles of 8-in. lateral in the Hilda area.

An experimental unattended compressor unit is proposed by Columbia Gulf Transmission for its Hampshire, Tenn., station. The company's FPC application states that Clark Bros. Co., the compressor manufacturer, will bear the expense of a 4,000-hp. two-cycle turbocharged vertical driving a centrifugal compressor engine which would cost $1,659,600, with Columbia having an option to buy at the end of the test period. This would be the first two-cycle centrifugal combination.

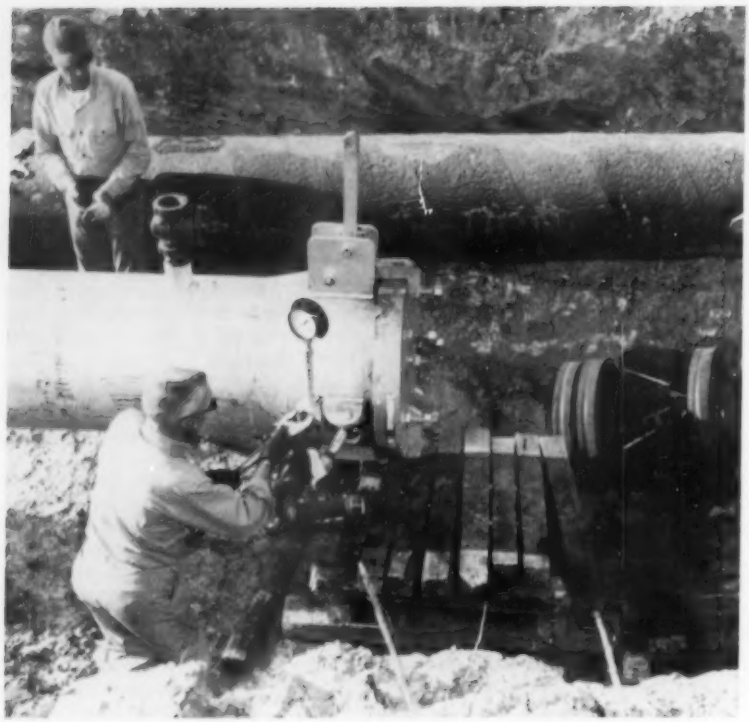
Gathering lines including 3 miles of 2-in., 58.5 miles of 4-in., and 2 miles of 6-in. will be laid this year by Arkansas Louisiana Gas. Some 77 miles of various 6-in. transmission lines also are planned. The company's 98-mile 16-in. gas line from Aetna field to Jones Mill, Ark., will be completed July 1.

Also for Pipeliners . . .

IN THE NEWS: FPC overrules examiner and approves Trunkline expansion and higher price for gas it must buy (p. 104) . . . House group has revived threat of divorcing oil pipelines from integrated companies (p. 106) . . . International cleaning and coating boosts gas-line flow, tests show (p. 108).

A complete list of pipeline projects is carried in the last issue of the month. Current projects are carried in Pipeline Briefs.

PLUS THIS TECHNICAL REPORT: Systems engineering for centralized control in pipelining (p. 154).



TESTING after internal coating. Last pig used in cleaning is at right.

Gas-Line Flow Boosted

. . . by internal cleaning and coating. Tests on 24-in. line point to coating as a cheap way of adding capacity.

DOES COATING the inside of a natural-gas pipeline increase its efficiency?

This question, which has long intrigued engineers, has been answered precisely in tests conducted under closely controlled conditions. The results showed that:

. . . **Deliverability** was boosted by about 5 to 10%, depending upon the rate of flow.

. . . **Some 4%** of the increase was directly attributable to cleaning.

. . . **An additional 1 to 6%** was attributable to interior coating with a thin epoxy film.

Tests were made on a 12-mile 24-in. line of Tennessee Gas Pipeline Co. near Refugio, Tex. They tend to verify the increased flow efficiency indicated in 1,000 miles of internally coated pipe on the Transcontinental Gas Pipe Line Corp. system (OGJ, April 6, p. 107).

This project was sponsored by Tennessee Gas Pipeline, Texas Gas Transmission Corp., Lone Star Gas Co., Transcontinental, Humble Oil & Refining Co., El Paso Natural Gas Co., Trunkline Gas Co., Coast Paint & Lacquer Co., Pipecote Service Corp., and Northern Natural Gas Co.

Test procedure . . . The section tested had been in service for 10 years without cleaning except for one wire brush-type scraper run when it was placed in operation.

Gas was pumped through the line at rates from 150,000 to 450,000 M.c.f. a day in a series of three tests using the ammonia-displacement method.

The section was first tested in its existing condition.

Next it was tested after cleaning by two separately run wire-brush scrapers.

Finally it was tested after further cleaning and then coated. The cleaning was done by two more scraper runs and a 3,000-gal. plug of methyl ethyl ketone. It was coated in place by Pipecote Service, Tulsa, providing a smooth "glass-like" unbroken interior lining for the entire length of the pipe.

Test implications . . . The results, reported by C. H. Klohn, Tennessee Gas Pipeline, showed a difference in flow behavior in operating pipelines and laboratory pipelines.

Klohn suggested a new "practical" smooth-pipe law to correct for the differences and permit a more accurate estimate of flow than present equations.

Although the report did not go into the economics of interior cleaning and coating, the efficiency gains were large enough to indicate a good payout. They point out a relatively cheap way to obtain increased capacity and reduce maintenance costs.

Raymond H. Crowe, chief engineer of Transco, predicted recently that if further work bears out the experience of his company, internal coating may become a general practice of the industry. And the results at Refugio offer more evidence to back up Transco conclusions.

Whether any significant deliverability gain can be obtained from internal cleaning is still a live question in the minds of many in the industry. But the Refugio project will serve to swing more companies to the side of the coating advocates.

Kaneb Is Expanding

. . . products line to more than twice present length.

A 279-MILE extension of the Kaneb Pipe Line Co.'s product lines in Kansas, Nebraska, and South Dakota was announced last week. Construction will start shortly, and the job will be completed this fall.

The multimillion-dollar expansion is in two parts:

. . . **A 168-mile extension** from the Kaneb Fairmont terminal near Geneva, Neb., to a point near Yankton, S. D.

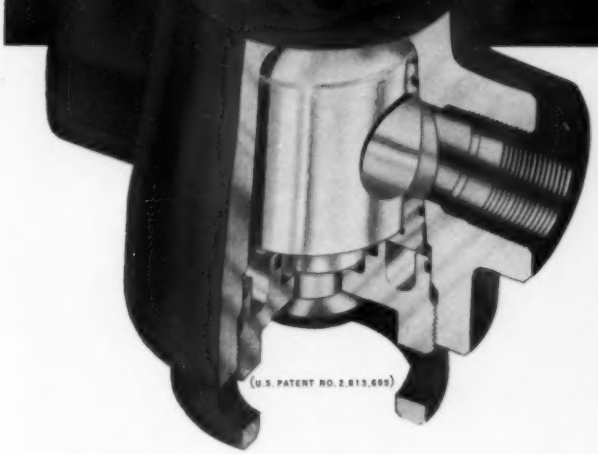
. . . **A 111-mile line** from the Cooperative Refinery Association's refinery at Phillipsburg, Kan., to the Fairmont terminal.

The two 6-in. lines will more than double the present 246 miles of Kaneb lines. The expansion includes two new pumping stations at Phillipsburg and Fairmont and multiproducts terminals at Norfolk, Neb., and Yankton.

Pipe Line Technologists, Inc., Houston, designer and construction supervisor of the original Kaneb lines, will handle the extensions. The present system consists of 200 miles of 10-in., 46 miles of 8-in., and six pumping stations. It originates in the Wichita and El Dorado, Kan., refining areas and extends to the Geneva, Neb., Fairmont terminal.

HALLIBURTON

LO-TORQ PLUG VALVE



surpasses existing field requirements

A new development by Halliburton . . . the most versatile plug valve ever designed for the higher working pressures and low torque operations . . . yet dependable under the most severe operating conditions. Its unequalled performance surpasses existing field requirements . . . is capable of carrying many varieties of fluids and slurries . . . in cementing, drilling, fracturing, acidizing and mud systems . . . functions at pressures to 15,000 psi . . . is strong and durable, yet light in weight.

Compare these features of the Lo-Torq plug valve with any other plug valve!

• **ECONOMY**. . . low initial cost—economical to maintain—parts easily replaced in the field.

• **DEPENDABILITY**. . . performs under the most severe and rugged field conditions—meets with Standard A. P. I. Testing Procedure for *drilling* and *production* plug valves.

• **DURABILITY**. . . body forging and adjusting nut of heat treated alloy steel is designed for greater dependability, minimum weight and maximum strength, passing destruction tests of 35,000 psi . . . split-tapered inserts permit easy one-time adjustment.

• **LOW TORQUE**. . . extremely low torque required makes valve more easily operated. Torque is reduced by use of a balanced cylindrical plug which is not subject to longitudinal loads. Simple adjustment sets the valve for the correct operating torque.

• **VERSATILITY**. . . performs with highest efficiency in all liquid, gas and slurry applications . . . in cementing, drilling, fracturing, acidizing, mud systems and numerous other applications.

• **AVAILABILITY**. . . immediate shipment of 1" or 2" sizes with split-tapered inserts in either non-ferrous alloy or durable cast iron direct from the factory at Duncan, Oklahoma.

Call your local Halliburton Representative . . . ask him for prices and new brochure on the "LO-TORQ PLUG VALVE" by Halliburton.

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HALLIBURTON OIL WELL CEMENTING COMPANY • DUNCAN, OKLAHOMA

TWIN SIGNPOSTS, one in English, the other in Arabic, point the way and the distance from Sidon, Lebanon, to the pump stations along Trans-Arabian Pipe Line. The most distant point is Saudi Arabia's Abqaiq field, which is 1,069 miles from Sidon.

Sidon: Business End of Big Crude Line

- This ancient port is one of the key oil installations in the Middle East. Sidon's terminal handles an average of 370,000 bbl. of crude daily moved through Tapline from Saudi Arabia.

(Seventh of a Series of Special Foreign Reports)

Paul E. Swain
International Editor

SIDON—A gleaming, new German supertanker appeared on the horizon off Lebanon's Mediterranean coast a few days ago and moved quickly, unerringly to a mooring at the largest of five sea berths a mile offshore from the Sidon terminal of Trans-Arabian Pipe Line.

The skipper, tall, gaunt Capt. Bernard Pilz, was looking for another record for his new ship. On her maiden voyage just a month ago the Esso Stuttgart lifted 338,435 bbl. of crude at Amuay Bay, a record for the Venezuelan terminal. The veteran German tanker skipper was doomed to disappointment. He threw up his hands in comic horror when he was reminded that the much bigger Universe Leader had already established a record Sidon lifting. But, on her second voyage, his new ship had a different distinction.

When the Esso Stuttgart pulled away from the berth the following day bound for Esso A.G.'s big Hamburg refinery, she was carrying the billionth barrel of Saudi Arabian crude to move through the big Tapline system to the eastern Mediterranean.

The Stuttgart had all her flags flying for the occasion, but other than that there was very little fuss.

The big 30-in. Tapline system which moves Saudi crude across the Arabian peninsula to the short-haul Mediterranean port was completed and put in operation November 10, 1950. Between then and April 23 when the billionth barrel arrived at the terminal storage, more than 7,000 tankers lifted crude at Sidon. Last year more than 370,000 bbl. daily moved through the system.

Mooring . . . Berthing a big tanker in open water to take on more than 330,000 bbl. of oil is not child's play, but Sidon's marine division makes it look easy.

The Esso Stuttgart was boarded while still far offshore by Capt. Haakon Walde, the mooring master, and the key man in the tricky mooring operation. With Capt. Walde giving the helmsman orders, the big tanker moved slowly but surely to

SIDON'S tranquil appearance is deceptive. The port has five sea berths which feed crude oil into tankers through underwater lines. Since the terminal opened in 1950, more than 7,000 tankers have picked up crude at the port.

DISCUSSING operations at the Sidon terminal are, left to right, Paul E. Swain, the Journal's international editor; Capt. Bernard Pilz, skipper of the Esso Stuttgart; Capt. Haakon Walde, mooring master at Sidon; and Capt. A. L. Hendrix, assistant marine superintendent at Sidon.

FLOW of crude into or out of Sidon is controlled from a shore-control center. At the control board are Tony Ghaby, left, and Alfred Hourani. All crude movement is controlled from one panel.

its berth, the biggest at Sidon. Lined up with shore markers, it came in like an arrow.

One anchor was dropped and then as the momentum of the big ship carried it on into exactly the proper position, a second anchor let go. The vessel was swung slowly to a position at right angles to the beach. Two of Sidon's launches, like playful dolphins cavorting about a whale, churned the waters around the big ship attaching mooring lines to seven buoys to hold the vessel. The whole procedure took less than an hour.

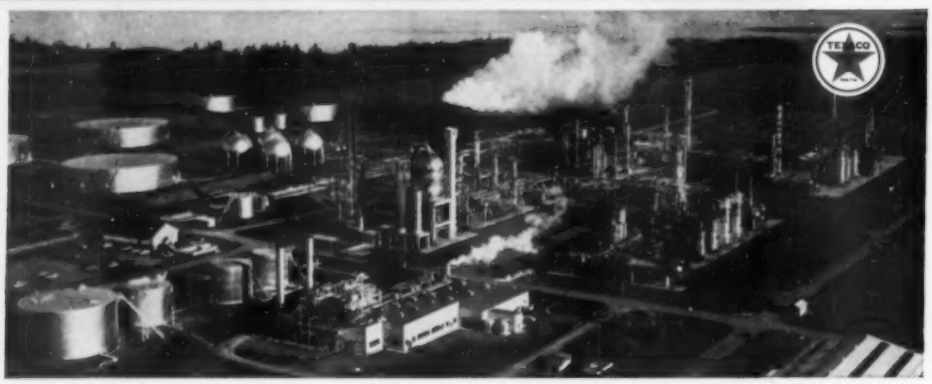
The buoyed, flexible connection to the 24-in. submarine loading line was snaked over the side by the Stuttgart's crane and the big heavy rubber hose connections were linked to the tanker's manifold. She started taking on Arabian crude at the rate of 40,000 bbl. an hour.

Because the open water of the eastern Mediterranean is subject to storms and the sea gets rough, Sidon has had trouble in the past with breaking these expensive hose connections during loading operations in heavy seas. Capt. A. L. (Al) Hendrix, assistant superintendent, marine, has come up with the answer to that one.

A Hendrix-designed coupling does away with the rigid bolted connection that caused the expensive breaks. One hefty swing of a sledge on a master pin holding the coupling releases the whole works quickly if rough seas and a heaving tanker threaten the connection. When this is necessary, the operator of shore control creates a vacuum in the loading line. The result is no lost oil, no broken connection, and another saving in equipment.

Shore control . . . The nerve center for Sidon's five sea berths, all of them about a mile offshore, is a small multiwindowed building on the beach just a few hundred yards from the sea.

In what is literally a push-button operation, the operator of this shore control center regulates the flow of crude and bunkers to every ship



$175 Million in New Refineries

General Petroleum Corporation. Ferndale, Washington. 37,000 barrels per day. Initial operation, 1954.

Shell Oil Company. Anacortes, Washington. 50,000 barrels per day. Initial operation, 1955.

The Texas Company. Puget Sound Works, Anacortes, Washington. 45,000 barrels per day. Initial operation, 1958.

All three major refineries now operating in the U.S. Pacific Northwest were designed and constructed from the ground up by Bechtel.

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berthed at Sidon. The day the Stuttgart berthed, the man at the keyboard was George Adbullah. Throughout the loading he was in constant radio contact with Capt. Walde aboard the vessel.

The end of the line . . . Behind it all is, of course, the big Tapline system which moves the crude to the Sidon terminal. Tapline's crude handling facilities are deceptively small and compact for the volumes of crude the station receives daily from the big line.

The station's 3,600,000 bbl. of storage consists of 22 floating-roof tanks on a high rocky bluff overlooking the terminal area and the sea. This area was a prime security point guarded by the Lebanese army during the recent "troubles," as everyone in Lebanon now calls the almost comic-opera revolution that never quite came off after the landing of the U. S. Marines.

Walking through the storage area, Capt. Hendrix scuffed the rocky ground with his foot and kicked up a "souvenir" of the occasion, an empty 30-caliber rifle hull.

"We had a little shooting around here," he remarked almost musingly. "Some fellas tried to break in one night and take over the refinery down there."

Then after a thoughtful look at the shimmering blue Mediterranean below, he amended his first statement with just a bit of force.

"Matter of fact," he said, "we had a helluva lot of shooting up here."

The 12,500-bbl. daily refinery of Mediterranean Refining Co. is on the beach just south of the Sidon terminal and only a short distance away. The refinery furnishes Sidon's bunker supply. The rest of its product output goes into the domestic Lebanese market.

Lebanese troops and five small tanks controlled the whole area from the bluff where Tapline's tank farm was built. The rebels never got to the refinery.

Along the east side of the storage area are the Tapline "signposts." In both English and Arabic, the signs indicate distances right back to the producing fields. The bottom arrow is "Abqaiq 1,069 miles." Above this one are separate arrows for the main pumping stations: Qaisumah, 754 miles; Rafha, 571 miles; Badanah, 394 miles; and Turaif, 246 miles.

Crude reaches the terminal from Turaif at 450 psi. At Sidon it goes into a pressure-reducing system of friction pipes to back the pressure down to 55 psi. before it is transferred to storage. This whole operation of handling the flow of crude into storage and out of the tanks to the shore control station is handled in one small, highly instrumented building halfway down the slope from the tank farm.

Regulating the Tapline flow into storage, gaging the tanks, and moving it on down to the sea-loading berth area are done on one large instrument panel operated by just two men.

The day the Esso Stuttgart lifted it's 330,000 bbl.-plus, Tony Ghaby and Alfred Hourani watched the gages as Tapline poured crude into the Sidon storage faster than the big tanker could take it out.

Pauley Says Strike Off Mexico Is Major Find

A MAJOR Mexican offshore oil field is being claimed by Pauley Pan American Petroleum Co.

The discovery well is the 239 Santa Anna located 1 mile offshore from the State of Tabasco in the Bay of Campeche.

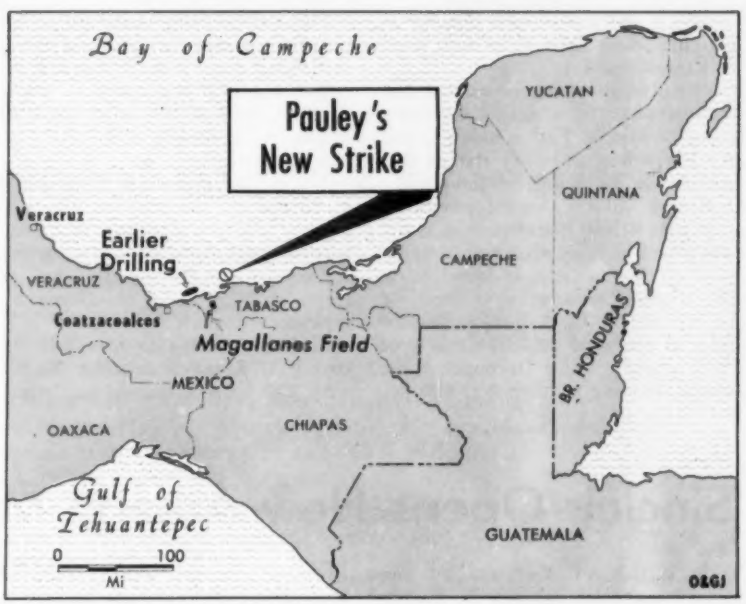
Edwin W. Pauley, president of the parent company, indicated the well struck at least two rich pay zones. He said the discovery tested at the rate of 1,680 bbl. daily of 38°-gravity crude from one upper zone in the Lower Miocene Encanto formation. The company, however, declined to release the size of the choke or the thickness of the pay zones.

Pauley reported the well was drilled to total depth of 10,000 ft. and several Miocene sands were encountered between 7,000 and 10,000 ft.

He said at least 100 wells will be drilled on the concession at an outlay of $20 million over the next 2 years.

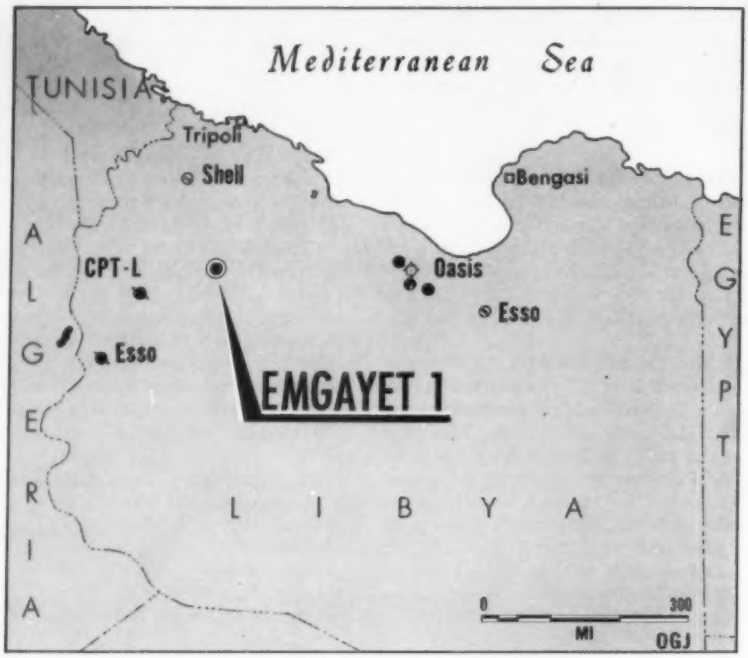
Pauley Pan American holds a concession from Mexico over 250 miles of the watery acreage. Nearest production to the discovery is onshore 10 miles southwest at Magallanes.

Pauley's contract with Mexico calls for his company to get 50% of the crude and 55% of the natural gas until wildcat costs are paid off. After that the Pauley percentages drop to 15% of the onshore oil, 18% of the offshore oil, and 18% of the natural gas. Contract runs for 25 years.



Ocean Drilling & Exploration Co. drilled the well in 43 ft. of water using its floating drilling barge "El Dorado." ODECO in previous drilling for Pauley operated on a participation basis. But work on the discovery was on a straight contract.

ODECO already had drilled nine holes previously in the Bay of Campeche area and got five producers and four dry holes. Four development wells were drilled in the bay near the onshore Rabon Grande field, about 5 miles east of Coatzacoalos. The fifth well was dry. The four producers, in the 2,000-3,000-ft. range, are rated at 500-bbl. daily but probably will produce at about one-half that rate.



Kuwait, Libya Yield Important Strikes

GULF Oil Corp. had a share in two important discoveries last week in Kuwait and Libya.

The Kuwait strike reportedly has the earmarks of a major discovery even by Middle East standards, and the Libya well definitely stamps that country as a coming oil nation.

Kuwait Oil Co., owned jointly by Gulf and British Petroleum Co., Ltd., completed its Mina Gish test 21 miles west of Burgan field. It found oil in the Ratawi limestone at a depth of nearly 10,000 ft. A 5-ft. perforated interval produced 1,660 bbl. daily of 34.5°-gravity crude through 5/8-in. choke. Flowing pressure was 600 psi.

The well is being deepened to investigate production possibilities of underlying Arab zone limestones.

Gulf's Libyan discovery is the 1 Emgayet, located 200 miles south of Tripoli in the middle of a 7,000,000-acre concession.

Test of an interval at about 4,100 ft. flowed at the rate of 750 bbl. daily of 35°-gravity clean oil. Drilling will continue to test deeper zones.

Emgayet is the fourth area in Libya to offer hope of commercial production.

The nearest find to the Gulf discovery is Libya Shell's Bir Tlacsin well, 120 miles southwest of Tripoli. The well is drilling ahead at 11,232 ft. It may produce 1,000 bbl. daily.

Esso Libya last week was setting pipe at about 5,400 ft. in preparation for production tests. Its well, located 110 miles from the Mediterranean coast and 200 miles south of Bengasi, has tested 100 bbl. per hour of 37°-gravity oil. It is on concession 6.

Oasis Oil has three discoveries on block 32, located 75 miles south of the Gulf of Sirte. These are Bahi 1, a 700-bbl. daily well; Dahra B1, which has swabbed at the rate of 480 bbl. daily; and Dahra F1, which tests at 30 bbl. per hour.

Sinclair Opens New Area in Monagas

A WILDCAT discovery by Sinclair Venezuelan Oil Co. in Eastern Venezuela has opened a new producing area in Monagas province.

The well, East Aguasay 1, is 8 miles east of Sinclair Venezuelan's nearest producing well in Aguasay field. The company believes the find may be a major extension.

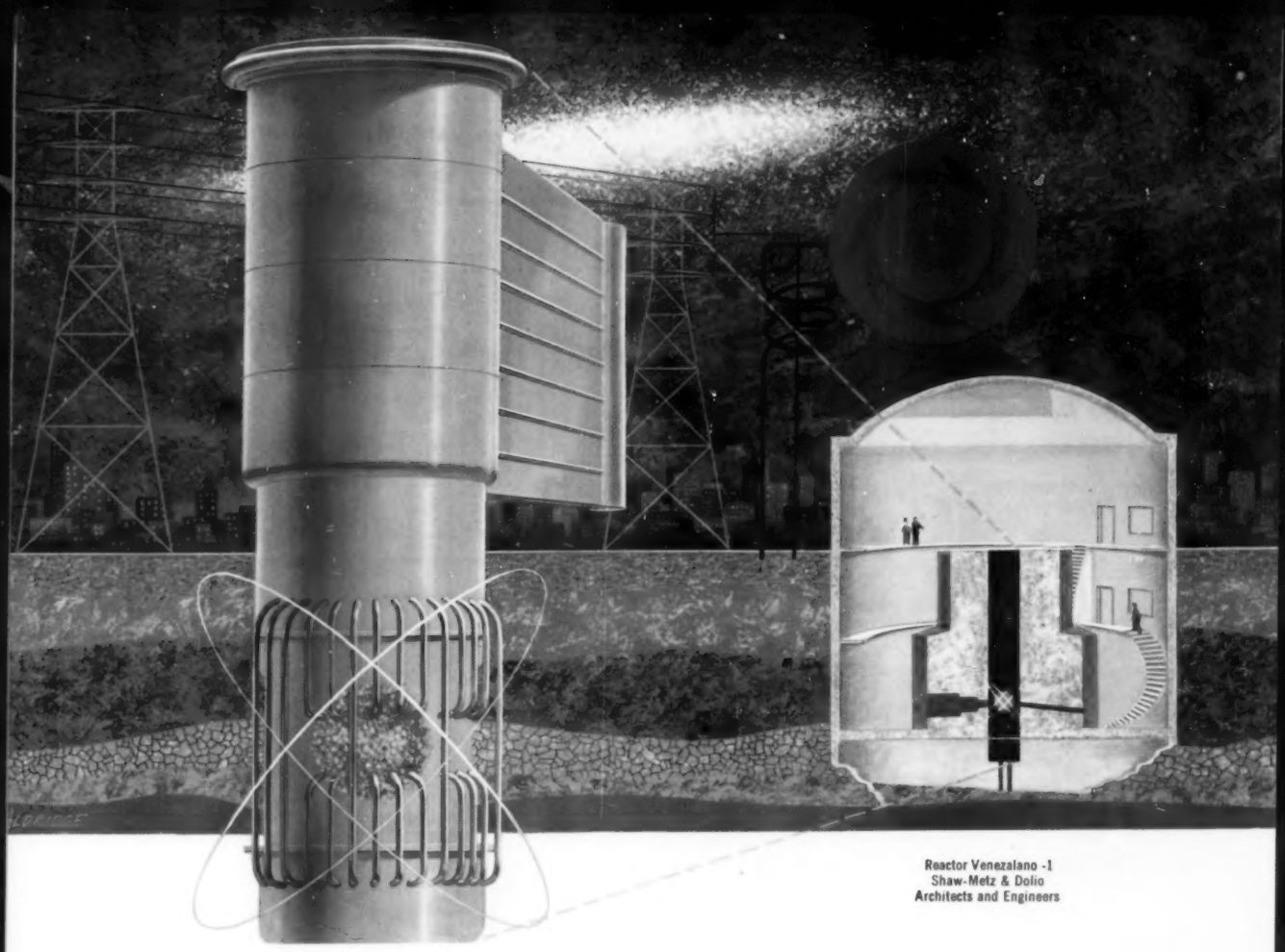
In official completion tests last week the well flowed 1,465 bbl. daily of high-gravity crude from two zones.

From the F-5 sand perforations at 12,617-52 ft., the well flowed 684 bbl. daily of 39.8°-gravity crude. From the F-1 sand perforations at 12,474-95 ft., the well flowed 781 bbl. daily of 41.6°-gravity crude. Both gages were on a 1/4-in. choke.

The discovery was made on a 12,765-acre concession block lying several miles east of the main, 92,600-acre Aquasay concession. A second well will be drilled about 3 miles east of the discovery to test the formation from which East Aguasay 1 is producing. Concessions between the two Sinclair blocks are held by Creole and jointly by Venezuelan Atlantic and Pancoastal Petroleum.

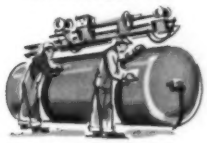
Sinclair discovered Aguasay in 1957, and the find greatly expanded the prolific Greater Oficina producing area. The East Aguasay production is the farthest northeast so far in Greater Oficina.

The company also has announced the completion of a 1½-mile stepout north of Aguasay itself.



Reactor Venezalano -1
Shaw-Metz & Dolio
Architects and Engineers

ENGINEERING



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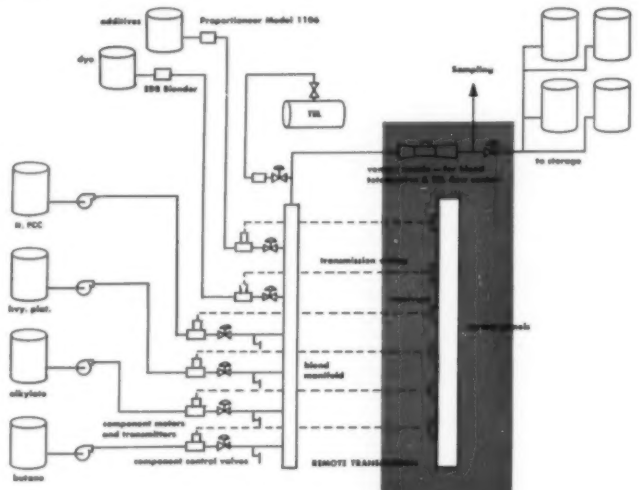

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Beginning

API REFINING REPORT

Sulfide scaling under hydrorefining conditions

Hydrogen sulfide partial pressure, temperature, and composition of steel are the main variables which affect corrosion rate. Graphical summaries of predicted long-term corrosion agree well with reformer data but are conservative for mildly corrosive hydrodesulfurizer conditions.

BY W. H. SHARP AND E. W. HAYCOCK
Shell Development Co.

PART 1 OF 3 PARTS

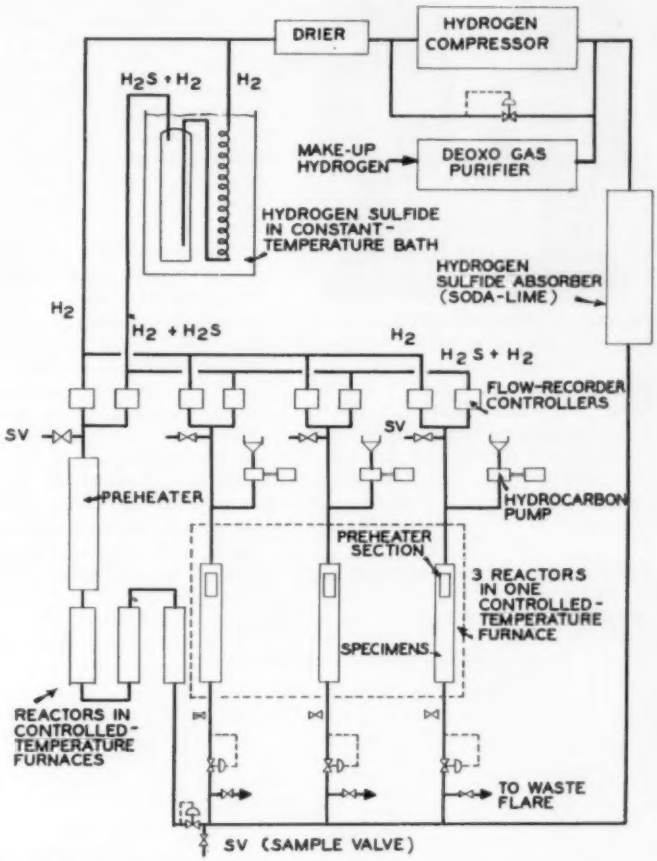
CORROSION RATES in sulfide scaling of ferrous alloys have been obtained from continuous-flow laboratory measurements under hydrorefining conditions.

Principal variables which determine corrosion rates of steels are hydrogen sulfide pressure, temperature, and composition of steel. No effect on corrosion was observed on reducing hydrogen pressure from 600 psia. to 60 psia.

Hydrocarbon exerted a depressing effect on corrosion at 700° F. but not at 900° F. Organic sulfides were found to contribute to corrosion only to the extent to which hydrogen sulfide was produced by their decomposition.

For design purposes graphical summaries of predicted long-term corrosion have been prepared. Predictions from these curves agree well with available reformer data, but are conservative when compared with rates observed under mildly corrosive hydrodesulfurizer conditions.

Paper presented at API Division of Refining midyear meeting, New York, May 27, 1959.

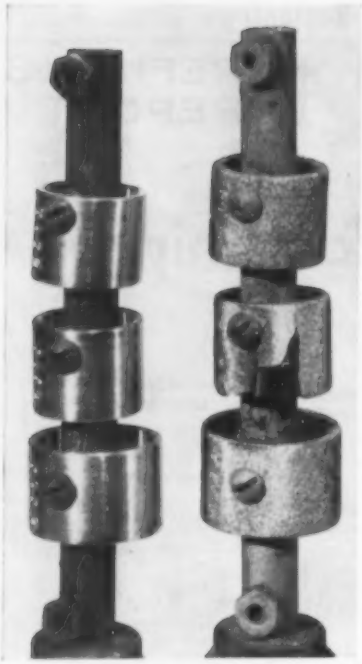


LABORATORY UNIT for obtaining sulfiding corrosion data. Fig. 1.

Obtaining the data . . . Sulfiding-corrosion data were obtained in a laboratory unit shown in simplified form in Fig. 1. The primary purpose of this unit was to provide controlled conditions for the uninterrupted exposure of metal specimens to gas streams containing from 0.3 to 150 psi. hydrogen sulfide in hydrogen at temperatures to 1,050° F.

For this purpose the unit was constructed of two stainless-steel reactor sections with auxiliary equipment for flow, temperature, and pressure control. The nucleus of each reactor section was a group of three furnace tubes. The furnace tubes of one group were connected in series so that many specimens could be exposed simultaneously to the same controlled hydrogen sulfide-hydrogen atmosphere at three independently controlled temperatures.

The three furnace tubes of the other section were installed in one large aluminum-block furnace so that all three tubes were at the same temperature. Each of these tubes was equipped with independently controlled supplies of hydrogen sulfide



TYPICAL CORROSION SPECIMENS before (left) and after exposure. Fig. 2.

and hydrogen and a positive-displacement pump for metering hydrocarbon. Specimen temperatures were maintained within a few degrees of the desired point by conventional thermocouple-actuated controllers and recorders.

Metering . . . Since reactor pressure in most cases was above the vapor pressure of hydrogen sulfide, it was necessary to resort to indirect means to meter the very small quantities required. This was accomplished by bubbling a side stream of hydrogen through liquid hydrogen sulfide in a bath maintained at constant temperature by solid carbon dioxide-light hydrocarbon, or ice-water, depending on the hydrogen sulfide partial pressure desired.

This hydrogen sulfide - enriched stream was then either fed directly to the specimens or diluted with hydrogen to obtain the desired reactor concentration. Gas flows from ½ to 50 std. cu. ft. per hour were metered at 700 psig. by small research control valves using lengths of stainless-steel hypodermic tubing (0.008 to 0.016 in. i.d., 2 in. to 4 ft. long) as orifice elements. Conventional transmitters and receivers were used to control and record flows to the reactors.

Hydrogen sulfide - hydrogen flows to the reactors were normally large enough to maintain the outlet hydrogen sulfide concentration within less than 10% below the inlet concentration. Hydrogen sulfide contents of reactor streams were determined frequently by absorption in dilute caustic of the hydrogen sulfide in a metered volume of gas.

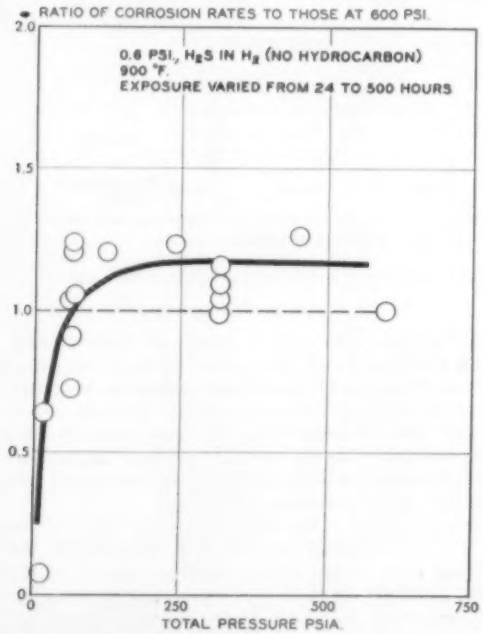
The absorbed sulfide was then reacted with an excess of acidified iodine and the excess iodine back titrated with sodium thiosulfate. Results of these control analyses were used to alter flow rates as necessary to maintain desired concentrations.

It was found that only a small per cent of the hydrogen sulfide was absorbed by hydrocarbon which was fed in some runs. This made it possible to maintain the hydrogen sulfide concentration by making control analyses on the gas phase only and by applying a correction factor determined previously to account for hydrogen sulfide in hydrocarbon.

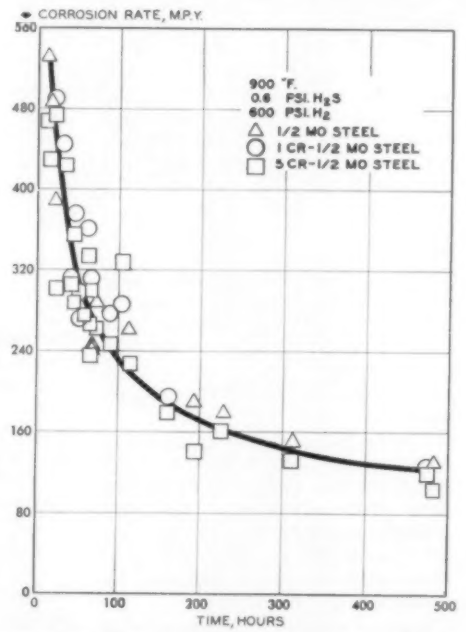
Reactor-effluent streams containing only small percentages of hydrogen sulfide were passed through soda-lime absorbers which removed the sulfide. The remaining hydrogen was then recycled to the reactor via a compressor, moisture absorbers, and hydrogen sulfide pickup vessel. Streams containing high hydrogen sulfide concentrations or hydrocarbon were sent to the waste flare.

Operation . . . Method of operation varied somewhat in detail over the wide range of conditions studied but the basic procedure was as follows: Specimens were protected with a blanket of nitrogen before runs until the equipment was pressure tight at operating temperature, and after runs until specimens were removed from the reactors.

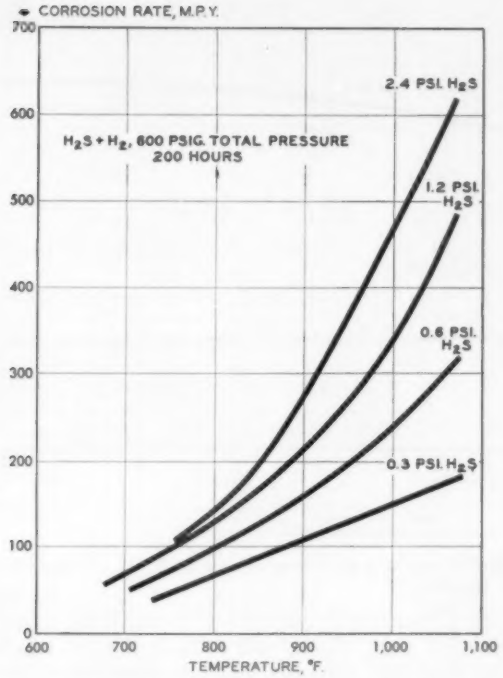
For low hydrogen sulfide concentrations or those in which hydrocarbon was fed, nitrogen in the reactors was replaced with hydrogen to operating pressure and all flows were started together. When the run required a high hydrogen sulfide concentration



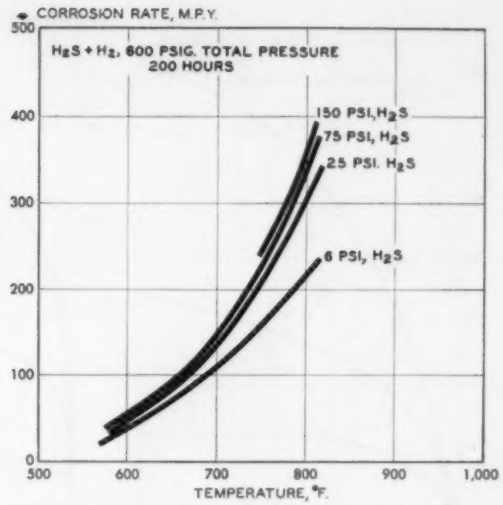
EFFECT OF HYDROGEN PRESSURE on sulfide rating. Fig. 3.



EFFECT OF TIME on corrosion rates of low-chrome steels. Fig. 4.



EFFECT OF TEMPERATURE on corrosion rate of 5 Cr—½ Mo steel at low partial pressures. Fig. 5A.



EFFECT OF TEMPERATURE on corrosion rate of 5 Cr—½ Mo steel at high partial pressures. Fig. 5B.

in hydrogen, low flow rates were used.

To expedite establishment of the desired concentration under these conditions, flows were started at the reactors under hydrogen at atmospheric pressure. At the conclusion of all runs reactors were purged with nitrogen, specimens were removed and stored with a desiccant until processed.

Test specimens were prepared in the shape of cylindrical rings so that the brittle sulfide scales inside the rings were retained under compression. These rings were tubing sections ½ in. long, approximately ⅝ in. o.d. with 3/32-in. wall. Specimens were mounted on support tubes as shown in Fig. 2 before exposure in the reactors. Compositions of the alloys are given in Table 1.

Before exposure, specimens were machined free of surface blemishes, edges smoothed, and the surface ground with 180-grit abrasive and rubber erased. After exposure, specimens were prepared as necessary for analysis, microscopic examination, or weight-loss measurements. For the latter purpose the bulk of the scale was removed manually after which adherent residues were removed by electrolytic cleaning in 5% by weight sulfuric acid followed by rubber erasing.

Feeds . . . Makeup hydrogen (specified by the supplier to be 99.8% H_2, 0.15% O_2, 0.05% N_2) was introduced to the unit via a Deoxo catalytic cartridge which converted essentially all of the oxygen to water which was removed in the drier and cold trap upstream from the hydrogen sulfide pickup vessels.

Part of the hydrogen was recycled after removing all hydrogen sulfide. Hydrogen sulfide used was specified to be over 99% pure; analysis by mass spectrograph confirmed the purity.

Hydrocarbon feed stocks used in several runs are described in Table 2. One of the platformate, boiling range 136° F. to 404° F.; the other was a light gas oil, boiling range 348° F. to 612° F. Both hydrocarbons were essentially sulfur-free.

Factors Affecting Corrosion

No effect on rate was detected in several runs using an atmosphere of hydrogen sulfide and hydrogen in which total pressure was varied from 600 psia. to 60 psia. while the hydrogen sulfide partial pressure was maintained constant. Comparison of rates of the reduced-pressure runs (see Fig. 3) with the bulk of the runs made at a total pressure of 600 psia.

TABLE 2—HYDROCARBON FEED STOCKS

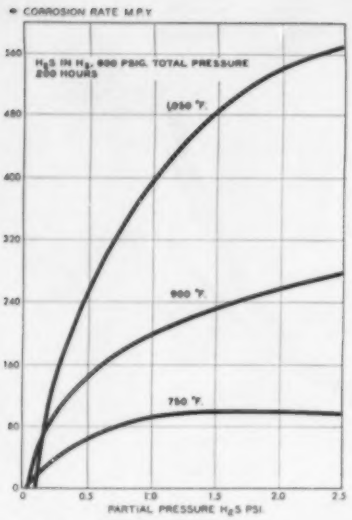
	Platformate	LGO*
Density at 68° F, g. per ml.	0.79	0.87
Molecular weight	115	193
Saturates, % by vol.	52.8	57
Olefins, % by vol.	1.2	0
Aromatics, % by vol.	46.0	43
Sulfur, % by vol.	<0.001	0.01
ASTM Distillation		
Recovered (% by vol.)	Temperature (°F.)	
Initial boiling point	136	348
5% point	...	402
10% point	216	413
20% point	234	435
30% point	242	457
40% point	256	478
50% point	268	498
60% point	284	520
70% point	298	543
80% point	316	572
90% point	342	610
95% point	370	(†)
Final boiling point	404	612

* Light gas oil, desulfurized.
† 8.5% residue by volume.

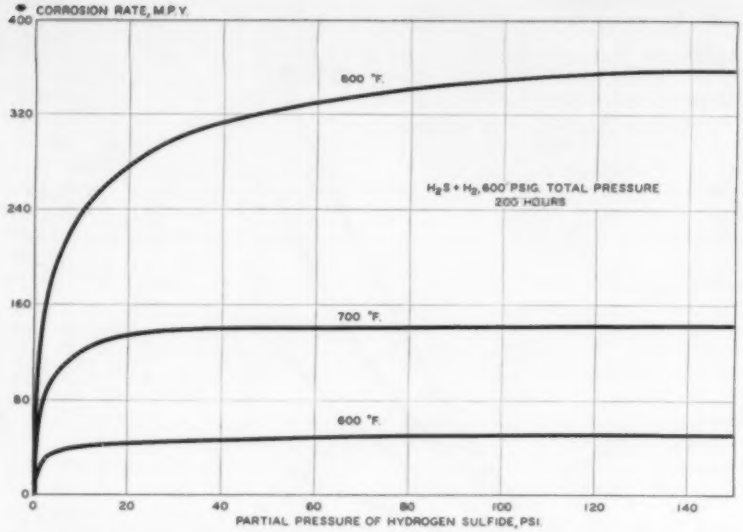
TABLE 1—ALLOY COMPOSITIONS
(Per Cent by Weight)

	Armco Iron	Ferrovac E*	½ Mo	1 Cr-½ Mo	1¼ Cr-½ Mo	4-5 Cr-½ Mo	9 Cr-1 Mo	12 Cr (Type 410)	18 Cr-8 Ni (Type 304)
Cr	...	<0.02	...	1.03	1.3	4.76	8.44	12.31	18.43
Ni	...	...	...	...	...	...	...	0.50	10.36
Mo	...	...	0.55	0.52	0.52	0.54	1.01	0.11	...
C	0.03	0.01	0.20	0.12	0.10	0.10	0.09	0.13	0.054
Mn	0.02	<0.02	0.56	0.50	0.40	0.35	0.42	0.65	1.71
P	0.003	0.004	0.018	0.017	0.011	0.022	0.012	0.010	0.014
S	0.02	0.001	0.025	0.017	0.018	0.011	0.015	0.009	0.010
Si	0.01	<0.03	0.22	0.30	0.71	0.33	0.36	0.55	0.48
Cu	...	<0.01	...	...	...	...	...	0.03	...

*Vacuum-melted pure iron.



EFFECT OF HYDROGEN SULFIDE pressure on corrosion rate of 5 Cr—½ Mo steel at low pressures. **Fig. 6A.**



EFFECT OF HYDROGEN SULFIDE pressure on corrosion rate of 5 Cr.—½ Mo steel at high partial pressures. **Fig. 6B.**

shows only random variations which might be expected from operation over a wide pressure range.

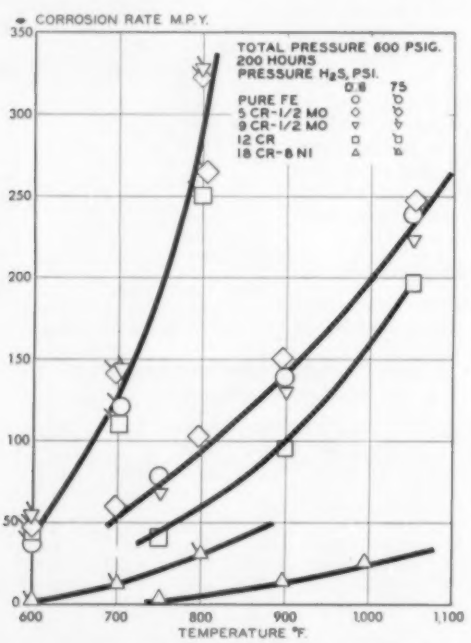
Further reduction of the total pressure to atmospheric resulted in a sharp decrease in corrosion. This decrease at low hydrogen pressure was also observed in several preliminary 6-hour runs at atmospheric pressure. These results showed rates far below those expected on the basis of extrapolation of data from Fig. 4.

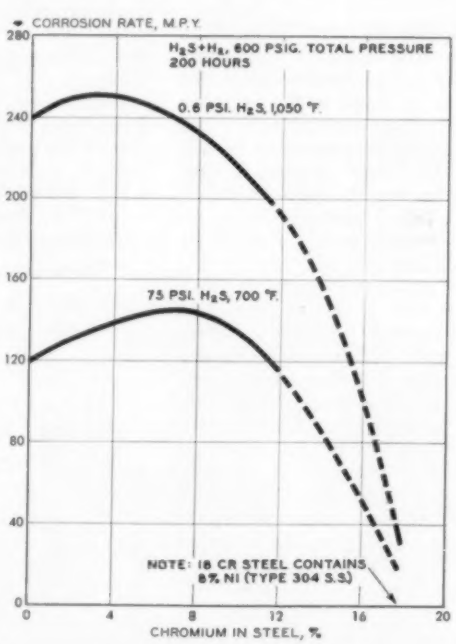
Temperature and H_2S partial pressure . . . The importance and interdependence of these two primary variables can be seen in Figs. 5A, 5B, 6A, and 6B. At 600° F. corrosion rates are relatively low and not sensitive to hydrogen sulfide pressure. However, as the temperature increases, the rate curves become increasingly steep with increasing partial pressure.

This effect is most significant in the range of reforming operations; small increases in partial pressure result in large increases in corrosion rate. In the hydrodesulfurizer range, rates are relatively insensitive to hydrogen sulfide partial pressure above approximately 1 psi.

Data referred to above are for 5 Cr steel, but 0, 9, and 12 Cr steels follow the same general pattern in hydrogen sulfide - hydrogen atmospheres. In fact, 18 Cr-8 Ni stainless steel (Type 304) also follows the same general pattern though at greatly reduced rates (see Figs. 7A and 7B).

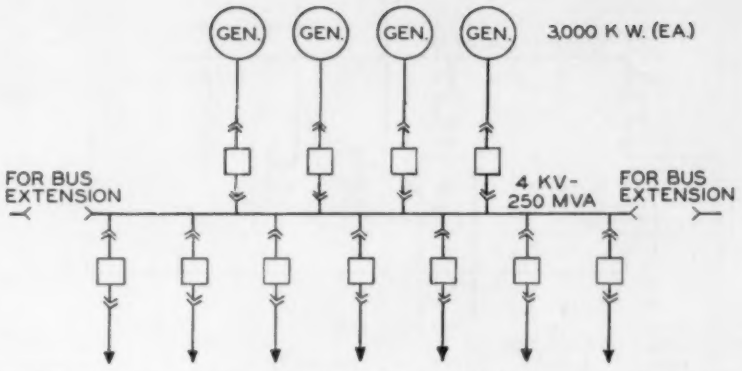
Part 2 will appear in the June 15 issue of the Journal.




CORROSION RATE, M.P.Y.
H2S+H2, 600 PSIG. TOTAL PRESSURE
200 HOURS
0.6 PSI. H2S, 1,050 °F.
75 PSI. H2S, 700 °F.
NOTE: 18 CR STEEL CONTAINS
8% NI (TYPE 304 S.S.)
CHROMIUM IN STEEL, %

EFFECT OF CHROMIUM CONTENT of steel on corrosion rate. Figs. 7a and 7b.

Whether you are starting from scratch or are modernizing antiquated specifications to reduce costs yet improve reliability, considerable savings can be gained if you . . .



IN-LINE divided bus arrangement installed in a plant having a simple topping and reforming process scheme. Fig. 1.

Plan power-distribution systems for future expansion

BY K. N. THOMPSON
Socony Mobil Oil Co., Inc.

LONG-TERM PLANNING can stretch investment dollars when installing new facilities and expanding or modernizing existing electrical distribution systems. The rapid growth in the use of electric power for oil refining justifies such long-range planning to insure maximum savings and still cope with the increasingly stringent energy requirements for modern processing units.

This trend will continue as crude-oil runs increase and the fractions of each barrel are handled more times for product upgrading. Heat and power needs amount to approximately one-third of the "cost of refining" crude oil. There is room for economy.

The distribution system offers one of the greatest opportunities for savings. Economic factors include the selecting of proper voltage levels, location of load centers, and adequate switchgear installations so that future growth is not hamstrung. A careful plan indicating the nature and timing of future expansions will help avoid the costly shortsightedness so evident when growth studies of existing installations are made.

Power Important

Table 1 shows that over-all United States refining capacity increased 57% in the past 10 years, although the number of plants dropped 19%. The crude-oil capacity of a typical plant rose from 17,000 bbl. per day to 32,500 bbl. per day as companies cut costs by running fewer but larger units.

A typical refinery's downstream capacity (disregarding lubricating oil and specialties) rose from 64% to 104% of crude oil.

Still these industry-wide trends partially hide the real extent of change. Consider five recently completed grass-roots refineries. The crude-oil capacity of these plants averages 60,000 bbl. per day and "downstream processing" capacity is 171% of crude oil.[1] These new plants show the need for operating continuity—each has only one crude-oil unit, only one catalytic cracker.

This changing refinery pattern shows why management is seriously concerned with the economical supply of energy. A single reforming unit today may require more power than the previous needs of an entire refinery. Today's cost for heat and power already amounts to around one-third of the whole cost of refining crude oil.

Table 1 shows how the use of electrical energy has increased; kilowatt-hours per barrel of crude oil refined rose more than one-third in the past 10 years. The five new plants use still more electricity. Naturally modern refineries are more demanding of and

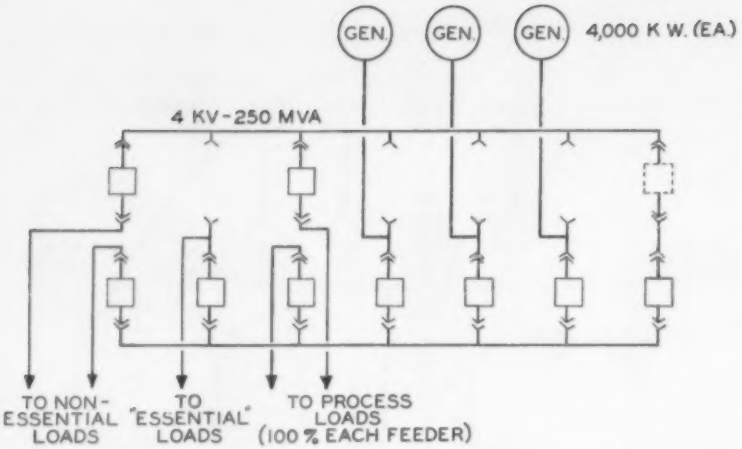
TABLE 1—TRENDS IN UNITED STATES OIL REFINERIES

	1948	1958	Change
Total crude-oil capacity, million barrels per day	6.25	9.8	+57%
Number of U. S. refineries	370	298	−19%
	"Typical" refinery data		5 Recent plants*
Average crude-oil capacity, million barrels per day	16.9	32.5	60
Downstream processing capacity (per cent crude oil)†	64%	104%	171%
Electricity used, kw.-hr. used per bbl. of crude oil	3.0	4.1	(?)

*The five recent plants used to indicate the trend are: Seaford, Va., Yorktown refinery, American Oil Co.; Delaware City, Del., refinery, Tidewater Oil Co.; Anacortes, Wash., refinery, Shell Oil Co.; Toledo refinery, Sohio Petroleum Co.; Ferndale, Wash., refinery, General Petroleum Corp.

†"Downstream" capacity excludes lubricating oil, polymerization, and specialty operations (Data from "A Growing Trend in Refining: More Downstream Processing," The Oil and Gas Journal, 56 (32) 74-5, Aug. 11 (1958).

Paper presented at API midyear refining meeting, New York, May 29, 1959.



DUAL BACK-TO-BACK switchgear installed in a plant located on the seacoast in a jungle area. It provides for independent shutdown of units. Fig. 2.

more dependent upon their electrical system. Yet refiners are increasingly attracted by the economy and reliability of electric service—vital to profitable operation of today's process installations which are designed for long runs.

Considering the increase in crude-oil runs and downstream processing, it is easy to understand why oil refiners are using nearly 2½ times as much electric power today as they did just 10 years ago. Still further electric-load increases are forecast, both by the five new plants, and by modernization plans oil people are developing for existing facilities. This permits the refiner to make processing more economical through extending use of electronic controls and motor drives.

Advantages of Planning

As refinery planners look for the most effective ways to hold down energy costs, they realize the advantage of long-range conservation programs. The rapidly increasing loads which result from doing more work on more crude oil make plant electrical systems a prime target for long-term development especially since refinery electrical installations age very slowly and show little evidence of technical obsolescence.

Even power equipment in process units is used 12 years or longer though several changes in technology may occur during that period. Fortunately, good design has kept the capital cost of electrical installations moderate—only about 8% of the total refinery investment if power is purchased, and around 12½% when the plant generates its own electricity.

Considerable savings can accrue from planning major portions of plant electrical systems for 10 to 25 years' growth. Many electrical design decisions must be made with the future in mind, such as selection of suitable distribution voltages and switchgear interrupting capacities, vital to low-cost expansion.

It is important to lay out plot plans and buildings so that space will be available for future generators, switchgear, transformers, feeders, and substations. These provisions are not costly.

Cost analysis . . . Socony Mobil Oil Co. analyzed the capital costs for seven refineries using purchased electric power (see Table 2). All these plants use motor drives extensively. Two plants are grass roots refineries recently built for affiliated companies.

In these, the cost of process units equaled the cost of plant facilities outside unit boundaries. However, when the replacement cost of five older Mobil refineries was analyzed, process units were found to be worth nearly one-third more than off-plot installations; the ratio is 57:43. The higher ratio apparently reflects a continued year-to-year capital improvement program whose emphasis is on processing.

It is interesting that, while electrical facilities in the two new plants cost 10% of all installations outside process areas, electrical systems make up only 5.2% of off-plot costs in the older plants. Power used in the newer refineries averages about 4.1 kw.-hr. per bbl. of crude oil, in the older refineries 3.6 kw.-hr. per bbl., so use of power does not explain the cost difference.

The conclusion seems clear—proper planning of electrical-distribution systems has allowed expansion and modernization of process facilities in particular, with very **modest** expansions of the plant electrical systems.

Design of New Facilities

When planning major new installations, the pattern of future growth must be studied to avoid the tendency toward shortsightedness. Both money and embarrassment can be saved by designing initial installations large enough to handle all expected load increases in the next 5 years.

It is also good practice to lay out the plot plan so that space is left to install equipment for roughly twice the initial power load in 10 years, probably quadruple the load in 20 to 25 years. Then future power installations can be planned and timed to minimize long-term investment and future grief. The plot-plan studies will also help in locating and arranging distribution centers so they may be expanded economically as load develops.

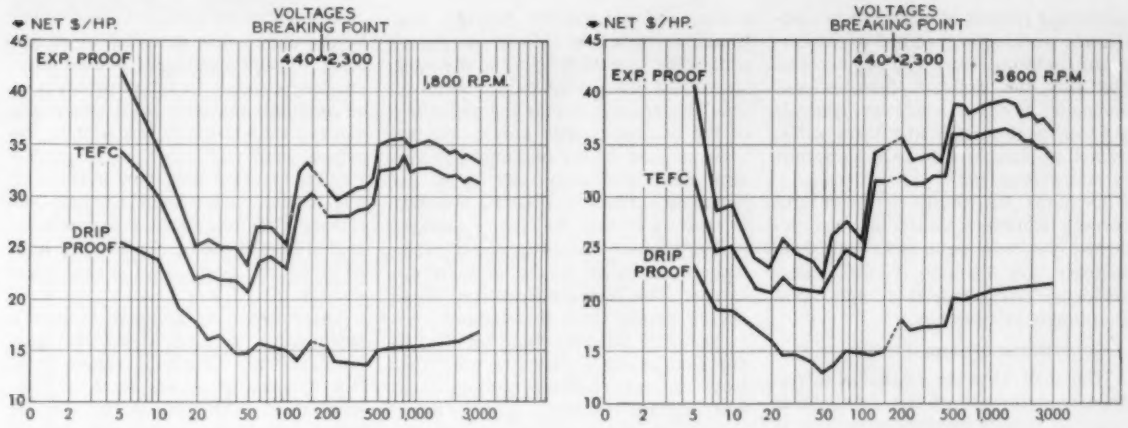
Experience indicates that well-arranged initial provisions for future expansion are quite inexpensive. The main requirement is space. Even a building can be extended cheaply if the designer arranges a removable wall and leaves clear ground for the expansion.

Many existing refinery systems have grown through a series of steps, each designed to economically handle load increases caused by installing or expanding process facilities. Even cursory study of these systems will show that more foresight 5 or 10 years ago would have allowed significant operative savings, avoided obstacles to greater productivity, and created profitable areas for major investment.

One refinery, for example, generates power and supplies it to a 20,000-kw. load at only 2,300 volts. This plant's main circuit breakers have higher than

TABLE 2—COMPARING NEW AND OLDER (EXPANDED) REFINERIES SHOWS HOW CAPACITY INCREASES REDUCE RELATIVE COST OF ELECTRICAL DISTRIBUTION SYSTEMS

	Two recent refineries (investment basis)	Five older plants (replacement cost basis)
Process units vs. "offsites" (all other) costs	50:50	57:43
Electrical costs "offsites" as per cent all "offsites"	10%	5.2%
Electricity (all purchased), kw.-hr. per bbl. of crude oil	4.1 approx.	3.6



SAVINGS of from $10 to $20 a horsepower are practical by using dripproof and weather-protected motors in Division 2 areas, as shown by these charts. Figs. 3A and 3B.

standard interrupting capacities, yet the reactors needed to safely limit fault currents also seriously limit the ability of the system to start large motors. This has led to excessive use of steam and gas-engine drives.

Although the electrical system maintenance has been good, and maintenance costs moderate, the plant's energy costs are obviously too high. The only major power-station failure in 40 years occurred many years ago. However, very competent people are needed to work on this system and any modification or further expansion will be very expensive.

Value of System Studies

Some companies make careful surveys of existing plant utility systems prior to modernizing, expanding, or adding new major process facilities. These surveys turn up ways of using present or immediate future system capacity to advantage and help in replacing or eliminating equipment of doubtful value. With technical evaluation, both realistic plans for handling large future loads and economical opportunities for major improvements in present systems may be found.

In one simple case, knowledge that two cables were so located in a manhole that they could be cross-spliced allowed a saving of more than $12,000 to be made by transferring load to a different substation, thus freeing excess capacity for a new service.

Good long-range electrical-system planning involves looking at alternate ways of handling growth. Several large refineries, faced with providing for major new facilities, have found the use of alternating-current network analyzers helpful. Analyzer studies of short circuit and load current flows enabled plant engineers to obtain a clear picture of the best ways of expanding and revising their systems.

Analyzer studies are particularly helpful when the plants generate their own power or are planning to start large motors. Also, the studies help in determining proper relay settings, and in setting up schedules for load shedding in emergencies. Plants which purchase electricity have a common problem which concerns continuing operation through voltage dips or switching surges.

It is often necessary to reenergize loads serially following momentary power interruptions to avoid excessive voltage drop or motor damage when resynchronizing.

Process operating plans . . . The designer of refinery electrical distribution systems will find that careful attention to process operating plans is worth while. Mobil people who are designing two foreign grass-roots refineries simultaneously verified this. For one plant having a simple topping and reforming process scheme they are installing the "in line" divided bus arrangement shown in Fig. 1.

This permits a reasonable amount of maintenance, provided scheduling is coordinated with turnarounds of plant units. The other plant has a two-stage crude-oil unit, catalytic reforming, desulfurizing, cracking, and polymerization facilities. The process equipment is designed for long runs. The refinery location is isolated so plant personnel must do most of the maintenance.

To use people efficiently and spread out the work load, the design provides for independent shutdown of units. For this installation, the dual "back-to-back" switchgear shown in Fig. 2 appears best, inasmuch as there will be no planned period when all processing is to stop simultaneously. The plant is located on the seacoast in a jungle area, so that careful maintenance is essential to reliable supply of power.

Two breaker cubicles are being provided on essential services to permit maintaining equipment without affecting process operations seriously. The switchgear cost is still moderate since expensive breaker elements are not duplicated. However, this is an unusual case.

It is seldom possible to justify double bus installations when using high quality "drawout" switchgear. Properly isolated, tightly enclosed buses seldom require inspection more frequently than once in 2 years. Also initial sizing of process units is seldom so tight that a short overlap in scheduled down time can be proven costly.

Safety aspects . . . In planning for safety with economy, it helps to remember there is an inherent risk just in the nature of refinery operations. The electrical designer should plan his systems so they will not increase the risk, but the most foolproof explosionproof installation known will not eliminate it. Process units still must be designed so operators can handle occasional flash fires without risking personal injury or damaging major equipment.

Installing an explosionproof motor outdoors may be rather costly insurance against creating an ignition hazard in case the insulation fails—especially since loss of a bearing in the motor can allow a shaft to rub and overheat, with the same risk of ignition. Refinery engineers who know of instances where explosionproof starters operated for months with many case-cover bolts missing wonder whether the area was even Division 2 let alone Division 1.

From the personal-injury viewpoint,

examining records of accidents to electricians working in cramped explosionproof enclosures may lead engineers to feel that the drawout features and adequate working space in general-purpose enclosures make them safer, as well as cheaper than explosionproof in many locations.

Certainly the ability to locate and correct trouble quickly in well-designed standard equipment can help improve unit operating factors; many accidents are associated with unit shutdowns or startups.

Better System Design

The API Division of Refining has sponsored several studies highlighting ways to stretch investment dollars in refinery electrical systems, including API RP 500: Recommended Practice for Classification of Areas for Electrical Installations in Petroleum Refineries.

As shown in Figs. 3A and 3B, it is practical to save from $10 to $20 a horsepower by using dripproof and weather-protected motors in Division 2 areas. Manufacturers studied the implications of API RP 500, realized these standard motor designs would be widely accepted, and developed new winding insulations which are water, dust, solvent, and corrosive-fume resistant.

At least two major oil-refining companies are putting these designs on new units. Incidentally, U. S. refiners now use twice as many motors as they did just 10 years ago.

The Division of Refining published the API RP 540: Recommended Practice for Electrical Installations in Petroleum Refineries this year. The API Subcommittee on Instruments has just completed the first draft of a manual on "Installation of Refinery Instruments and Control Systems."

The API National Electrical Code Coordinating Committee was helpful in obtaining approval to use mineral insulated cable in Division 1 locations. This committee needs industry backing in its effort to obtain approval for use of armored cable in Division 2 areas. This will permit the virtual elimination of costly rigid conduit in refineries when desirable.

Shell Oil Co. people made two major refinery electrical installations in 1953. At one plant they distributed electricity with aerial cables supported on overhead racks and messenger wires. The conventional conduit and underground distribution was installed in the other plant. They found the overhead cable system cost less than half the underground conduit system.[2]

The principal advantages of underground conduit distribution are that this method protects against fire, storm, and mechanical damage, and minimizes possible risk to personnel unfamiliar with electricity. So the most significant point from over 5 years of Shell experience is that the reliability of the overhead cable installation has been as good as the underground system; both have been fully up to expectations. Thus it appears practical to save up to half the cost of outdoor refinery wiring by using aerial cable, where congestion in the areas is not serious. The National Electrical Code should permit these installations.

The API Subcommittee on Electrical Equipment is working on other ways to cut electrical system costs and improve reliability. This group is investigating the advantages of "intrinsically safe" control devices which our English friends have long preferred. Also, the group is favoring the use of static switching instead of contact making relays in order to make controls much more reliable.

Static switching is especially helpful for safety interlock systems; these services require few switching operations during long periods so contact assemblies tend to corrode or stick. Also, because static switching devices operate without any sparking, these devices will permit safe, economical control installations to be made in Division 2 areas.

Factors in Modernization

Several oil companies have been able to make major savings when modernizing refinery electrical systems. Both large and small refiners have shut down inadequate generating facilities, purchased utility power through high-capacity substations, and have met part of their process steam and power needs by utilizing waste heat.

Witness the current trend toward CO boilers in cracking units. Minor production bottlenecks were eliminated by replacing or modernizing obsolete and unsafe substations. In some cases circuit breakers and fuses have been replaced in the same enclosures by modern elements having higher interrupting ratings. As process modernization called for more energy, motors were rewound using new insulating materials to give as much as two-thirds more horsepower in the same frame.

Transformers were cooled by forced-air blast, or replaced with compact, higher-capacity units. Wires and cables were replaced by conductors having greater current capacity using modern insulation with the same outside diameter as the older wires. Power-factor correction with capacitors installed near the load allowed increased outputs.

Modernization savings have resulted by the use of new materials or equipment. Phillips Chemical Co. used polyethylene conduit to fight corrosion in an ammonium sulfate plant where galvanized steel lasted only 1 year in the sulfate and salt-water atmosphere.[3] Phillips reported that the polyethylene has virtually eliminated conduit corrosion. They also found that the installed cost of plastic conduit was only 45% of the cost of equivalent steel conduit.

One major oil company found a supervisory control system economical when arranging remote control of loading pumps from a tank-truck rack. With this control, a whole group of pumps are started or stopped over one pair of wires.

The real payoff came when it was necessary to make some changes in pump services. This required only minor shifting of connections instead of the extensive rewiring required if conventional controls had been used.

Some companies are effectively using high-voltage floodlighting to reduce the need for costly local area lighting.

Specifications . . . Oil companies could well afford to pay more attention to their electrical specifications. In many cases these tend to continue practices of many years ago. The classification of areas may have ignored changes in electrical codes, ignored better ways of building process units (extensive pump rooms are not built in moderate climates any more), ignored better mechanical equipment (pumps with mechanical seals leak much less than the old packed pumps), and, surprisingly, ignored even the major improvements in electrical equipment, such as motor insulation.

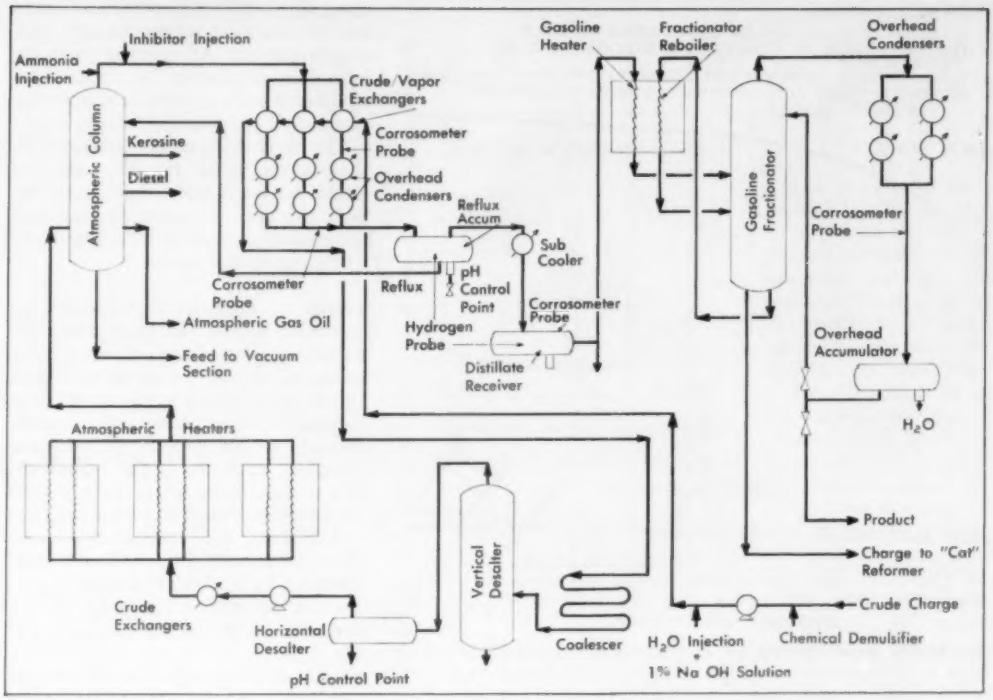
Thus company specifications may force the construction of electrical installations which are too expensive, use special equipment where it is not required, and are both difficult and costly to maintain. Fortunately the API studies previously mentioned are available as guides to modernizing specifications. Several large oil companies have already changed some practices and are sponsoring further cost reduction studies.

References

1. "A Growing Trend in Refining: More Downstream Processing," by Larry Resen, The Oil and Gas Journal **56 [32]** 74-5, Aug. 11 (1958).

2. Remarks of J. G. Wilson, Shell Oil Co., N. Y., Proceedings of the Westinghouse International Oil Forum, New York, Mar. 6 and 7 (1958).

3. "Polyethylene Reduces Plant Corrosion," Petrol. Engr. **30 [10]** C-11, Sept. (1958).



CRUDE UNIT, showing desalting, atmospheric section, and gasoline-fractionating sections. Fig. 1.

What Ohio Oil learned in 5 years of

Processing crude oil at low pH

Turnaround inspections, 18 months apart, have shown all equipment to be in excellent condition. No replacement has been needed due to corrosion in overhead system.

BY J. A. BIEHL AND E. A. SCHNAKE
Ohio Oil Co.

APPROXIMATELY 5 years ago, Ohio Oil Co.'s refinery at Robinson, Ill., lowered the pH on crude-oil overhead receiver waters from an average of 7.5 to 4.3, increased the inhibitor injection into the vapor overhead from 6 to 10 p.p.m. to 10 to 15 p.p.m. This change to lower-pH operations resulted in excellent control of corrosion, cleaner equipment, and reduction of ammonia contamination in the hydrocarbon streams.

Corrosion rates have been monitored by water analysis, hydrogen probes, electrical - resistance - type probes, and corrosion test coupons. All methods have shown very acceptable corrosion rates.

Paper presented at API midyear refining meeting, New York, May 28, 1959.

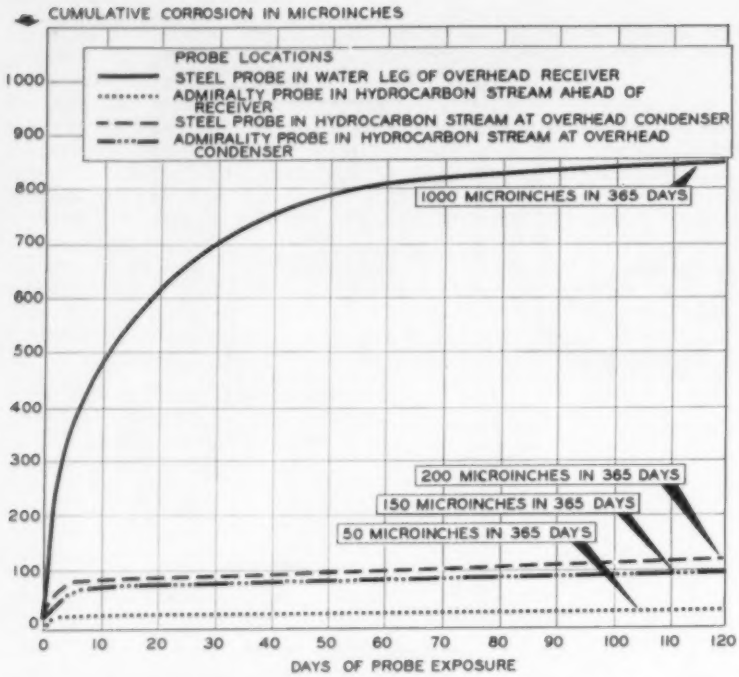
The clean equipment obtained at the low pH operation has greatly reduced maintenance costs at scheduled turnarounds and permitted longer runs at increased charge rates.

The reduction of ammonia contamination in the hydrocarbon streams has improved the reformer charge stock quality, lowered the costs of chemical treating of distillates, and minimized the quantity of corrosive agents in diesel fuels.

Crude distillation . . . The crude oil processed at Ohio Oil's Robinson refinery during the 5-year period of low pH on overhead receiver waters had an average API gravity of 36°, a sulfur content of 0.23%, and an average salt content of 30 lb. per 1,000 bbl. expressed as sodium chloride. During this period, the refinery has had limited runs of higher-sulfur crude oil.

Before processing, the crude oil is desalted in a chemical desalting unit. A demulsifying agent is injected into the raw crude-oil stream ahead of the crude-oil pump suction. A 5% by volume of water and a 1% solution of sodium hydroxide are also injected into the crude oil ahead of the desalters.

A pH of approximately 8.0 is maintained on the water effluent from the horizontal desalter vessel by regulating the caustic injection. The desalter



CUMULATIVE CORROSION MONITORING by electrical resistivity probes. Fig. 2.

effluent water enters the refinery sewer system. The desalted crude-oil charge to the unit averages approximately 1.23 lb. of salt per 1,000 bbl.

The efficiency of the desalting process averages 95%. A general simplified flow of the desalting, atmospheric, and gasoline fractionating sections is shown in Fig. 1.

A rather complete description of unit flow and construction materials was given in a previous paper.[1] All crude-oil unit overhead equipment, operating at low pH on overhead receiver waters, is constructed of the conventional materials, carbon steel and admiralty.

All overhead piping, exchanger and condenser shells, heat-exchanger tube bundles, and overhead receivers are constructed of carbon steel; however, overhead condenser bundles are constructed of inhibited admiralty.

Corrosion and Monitoring

Since operating at low pH, turnaround inspections of the crude unit have been scheduled at 18-month intervals. These inspections have indicated that all equipment was in excellent condition and nothing has had to be replaced as a result of corrosion in the overhead system.

From the start of low-pH operation, corrosion rates were closely checked by means of removable test coupons, hydrogen probes, and analyses of overhead waters for iron and copper content. All of these methods indicated satisfactory protection of equipment once a protective film was established on clean surfaces.

The removable metal test coupons showed the initial rate of corrosion attack on clean metal surfaces to be high but once a protective film was established corrosion rates were well within acceptable limits.

12 Months of operation at pH of 6.8-7.5 with NH_3 injection only.	12 Months of operation at pH of 6.8-7.5 with NH_3 + 6 p.p.m. of organic amine inhibitor injection.	5 Years of operation at low pH of 4.0-4.5 with small amount of ammonia injection+amine inhibitor injection rate at 9-12 p.p.m.
Carbon Steel		
General Rate 0.04 i.p.y. Pitting Depth 0.07 i.p.y.	General Rate 0.01 i.p.y. Pitting Depth 0.03 i.p.y.	General Rate 0.001-0.004 i.p.y. Very Mild General Pitting
Heavy scale on equipment plus heavy sludge deposits	Light scale on equipment plus light sludge deposits.	Very light scale or film.
Inhibited admiralty		
Severe pitting at condenser inlet only and general heavy attack under sludge deposits at rate of 0.06 i.p.y.	Severe pitting at condenser inlet at rate of 0.05 i.p.y. Moderate attack under sludge at rate of 0.025 i.p.y.	Very mild general overall attack less than 0.002 i.p.y.
Stress Cracking	No Cracking	No Cracking

REVISED CORROSION RATES at crude unit atmospheric and gasoline-overhead equipment. Fig. 3.

Probes . . . Electrical-resistance-type corrosion probes[2] of both steel and admiralty were installed at various locations in the crude-oil overhead system as indicated in Fig. 1. In order to obtain a true picture of corrosion throughout the system, probes were installed from the point condensation of the stream starts down to and including the water leg of a receiver.

The graph, Fig. 2, shows the cumulative corrosion of microinches (millionth of an inch) plotted against service time of probes. The graph clearly indicates the initial rate of attack and the time required for a protective film to be established at the low-pH conditions. All probes in the hydrocarbon stream indicated a moderate attack the first few days but stabilized after about 10 days of exposure.

The steel probe, located high in the overhead system, showed a cumulative corrosion of 50 μin. the first 24 hours which represented a rate of attack of 0.018 i.p.y. The cumulative corrosion for a period of a year, however, was 0.0002 i.p.y. All admiralty probes indicated very low attack.

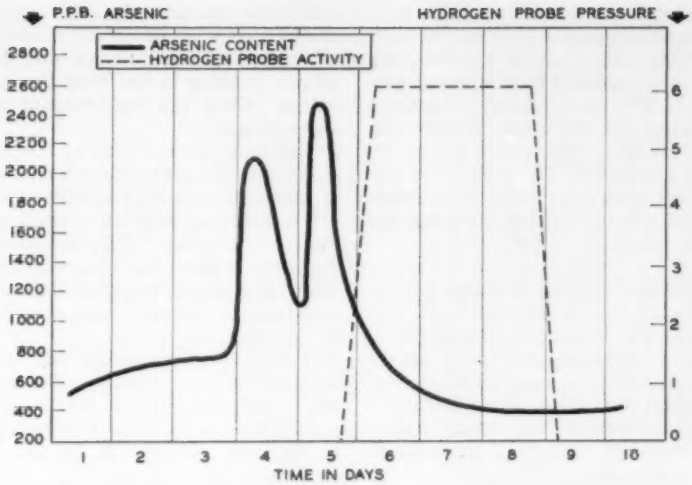
The steel probe in the water leg of the receiver indicated the highest initial rate of corrosion and approximately 60 days of exposure was required for a good protective film to be established; however, the corrosion rate over a period of a year was low and well within acceptable limits as shown in the following tabulation:

CUMULATIVE CORROSION OF STEEL SAMPLE IN WATER LEG

Microinches—	Corrosion rate, i.p.y.
180 in 1 day	0.07
700 in 30 days	0.008
830 in 60 days	0.004
1,000 in 365 days	0.001

The revised rates of low-pH operation with inhibitor injection rates of 9 p.p.m. to 12 p.p.m.—as compared to the corrosion rates when operating at: (1) high pH and ammonia, and, (2) high pH and ammonia plus inhibitor—are shown in Fig. 3.

At high pH operation, fouling of overhead equipment with heavy sludge deposits ahead of exchanger baffles



HYDROGEN PROBE ACTIVITY following high surges of arsenic. Fig. 4.

and in areas of low flow rates was a serious problem. This resulted in shorter runs at decreased capacities because of inefficient heat or cooling transfer surfaces; also increased corrosion occurred under the sludge deposits.

A low pH, equipment remains clean and free of objectionable salt and sludge deposits. Cleanliness of operating heat exchange and condensing equipment permits longer runs between scheduled shutdowns at increased capacities. Bundles are clean after 18 months' service at low-pH operations.

Crude Unit Hydrogen Ion Activity

During the past few years, the crude-oil unit has experienced periods of hydrogen-ion activity in the distillate receiver. This activity was indicated by a hydrogen probe installed at the oil-water interface. Since this activity was intermittent and relatively low, no serious problem existed; however, it was desired to determine the cause of this condition.

Earlier study of this condition indicated that arsine might be a contributor to hydrogen-ion activity. It was believed arsine would form in the fractionation section of the crude-oil unit inasmuch as the crude-oil charge contained considerable arsenic.

Since a slight reducing condition exists in most crude-oil units, the presence of arsine is very probable. It was believed the arsine gas would pass overhead into the distillate receiver and result in arsenic plating and formation of atomic hydrogen. This atomic hydrogen would therefore cause hydrogen probe activity.

Although it is practically impossible to obtain samples to confirm the presence of arsine, a program was outlined to obtain samples of the receiver water prior to and after hydrogen activity for total arsenic determinations. The values obtaintd were plotted against the hydrogen probe activity and the result is shown in Fig. 4.

It is interesting to note from this graph, that hydrogen-ion activity occurs following a surge of high arsenic levels. This condition follows approximately 36 to 48 hours after the existence of high arsenic content and the activity remains for approximately the same length of time as this high arsenic level exists. This pattern was repeated several times so it is fairly evident arsenic has a definite role in hydrogen-ion activity.

Arsenic contents of the many Illinois basin crude oils were determined and found to vary considerably. This accounts for the occasional high arsenic surges noted in the overhead receiver water. Although the condition has not been serious, it might be in the future should high-arsenic crude oils be refined with regularity. Studies have been and are being made to combat this problem as follows:

1. Investigation of arsenic removal from crude oil by operational changes in desalting. These changes are primarily oil-water ratios, improved mixing, temperature variance, and control of pH of the desalter water. It has been reported that oil-water ratios and mixing have a definite bearing on efficiency of arsenic removal by desalting operations.

2. Investigation of inhibitor protection against arsine attack. If an inhibitor provides a complete and stable film on the equipment, the release of atomic hydrogen by deposition of arsenic from arsine will be minimized.

3. Introduction of small quantities of air into the crude-oil fractionation system to provide a slight oxidizing condition. This would minimize the formation of arsine in this section and control the hydrogen-ion activity in the receiver section from this constituent.

Effect of Ammonia

The presence of ammonia and ammonium salts in the hydrocarbon streams from crude-oil distillation have definite effects on several refinery processes and also on the quality of products. Operation of crude-oil units at low pH on overhead receiver waters minimizes the quantity of ammonia and its salts present in these streams.

The formation of ammonia from the organic nitrogen compounds in process charge stocks will continue as this is an internal source which cannot be controlled unless the stock is subjected to a chemical treatment.

Prior to the low-pH operation of the crude-oil unit, considerable fouling occurred in the heat exchangers of the catalytic reformer pretreatment section (Fig. 5). Analysis of the fouling material showed the presence of ammonium salts. The fouling was also attributed to the oxidizable sulfur compounds and dissolved oxygen.[3]

Shortly after this trouble, the pH was lowered on the crude-oil unit receiver water and the oxygen in the catalytic reformer feed reduced by gas blanketing of charge tanks. These changes eliminated the fouling difficulties. When charging material to the reformer which contains basic organic nitrogen compounds, ammonia is formed in the guard case section. The majority of the ammonia passes overhead in the prefractionator tower and deposits in the gas lines resulting in restricted flows.

A portion of the ammonia remains in the reactor charge stock and enters the reactors and there disturbs the catalyst activity by reduction of acidity. To counteract this condition, it is necessary to add chlorides continuously to maintain the desired catalyst acidity for greatest efficiency and longer life.

These basic organic nitrogen compounds can be removed from the reformer charge by acid treatment, thus eliminating the deleterious effect of ammonia. By operating at low pH on the crude-oil unit, the external source of ammonia in the reformer stock is kept at a minimum.

At Robinson, Ill., the light straight-run gasoline and kerosine streams are treated by the Linde copper process and the presence of ammonia in these two streams has a marked effect upon the treatment. When operating at high-pH levels at the crude-oil unit, am-

monia is entrained in the streams and passes through the caustic hydrogen sulfide scrubbers and enters the treating process.

At this point, the ammonia will react with the liberated hydrogen chloride from the mercaptan conversion to disulfides and thus prevent the regeneration of cuprous chloride to cupric chloride. The cuprous chloride, being soluble in the hydrocarbon streams, will be removed from the slurry tower and attack the product lines, particularly at bend areas.

This results in deposition of metallic copper and the formation of iron chlorides. Continued corrosion attack resulted in several line failures. The iron chloride dissolves in the hydrocarbon streams and results in product discoloration, particularly on kerosine. With the crude-oil unit operation at the low-pH value, the ammonia in these two streams is minimized and the treating program has operated smoothly. The change to lower pH has improved the treating process as follows:

1. Treating chemical savings.
2. Reduction of corrosion.
3. Improved color of treated products.
4. Lower metal deactivator requirements.

Diesel fuel . . . Prior to the low-pH operation, frequent trouble with ammonia in diesel fuel was encountered. The ammonia in this product caused failure of sintered copper filters in large diesel installation, as well as deterioration of copper fuel lines. The ammonia and ammonium salts caused increased corrosion of diesel storage tanks. The excess ammonia accelerated dissociation of the ammonium salts liberating gaseous ammonia and forming of mineral acids.

The ammonia migrated to the hydrocarbon phase and the acids concentrate in the aqueous phase. As these acids formed, the tank bottoms were attacked, resulting in accelerated corrosion. With the reduction of ammonia injection into the crude-oil unit, contamination of the diesel stream by this constituent was reduced. Complaints from customers were minimized and storage-tank corrosion has been retarded.

Cracking units . . . Although no specific effect was observed with ammonia and its salts in gas-oil charge stock to cracking units, it is a proven fact that nitrogen compounds adversely affect the activity of fluid catalysts. At some critical temperature, hydrocarbons will react with ammonia to form cyanide.

The hydrogen cyanide effect on equipment has been reported by other authors, particularly with regard to hydrogen blistering.[4] The Robinson refinery experienced an accelerated formation of hydrogen cyanide gas when operating at high throughputs and reactor temperature over 905° F. The higher throughput provided more entrained oxygen in the catalyst from the regeneration section.

As in the catalytic cracking operation, no noticeable effect was observed in the sulfuric acid alkylation process when the change was made from high to low-pH range at the crude-oil unit. Any ammonia present in the charge comes from an internal source (cracking operations) or as ammonium sulfate present in the purchased sulfuric acid. The unit had failure of admiralty tubes in the deisobutanizer overhead condenser as the result of ammonia.

The ammonia entering the unit with the charge is removed in the reactor section by the formation of ammonium sulfate which is soluble in the acid; However, a quantity of acid is carried by the reactor effluent which is subjected to caustic scrubbing. When the acid in the reactor effluent is neutralized by caustic scrubbing, the dissolved ammonium sulfate also reacts with the caustic resulting in the formation of sodium sulfate and the liberation of ammonia gas.

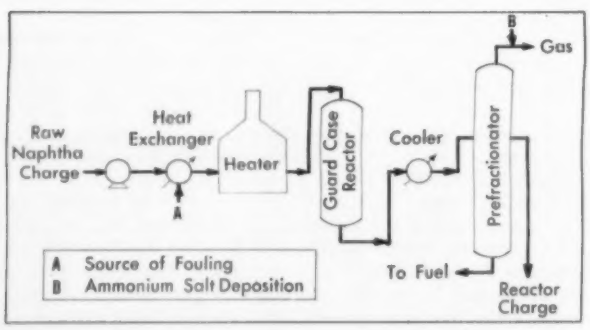
The water wash, following caustic scrubbing, does not completely remove the liberated ammonia inasmuch as the pH is relatively high as a result of caustic carryover. The ammonia, therefore, enters the deisobutanizer tower and passes overhead into the condenser to promote stress cracking of the admiralty tubes.

It has been determined that the majority of this ammonia for this attack originates from the ammonium sulfate in the fresh acid makeup to the unit, especially if the acid is reclaimed.

Coker operation . . . Lowering of the pH on the crude-oil unit overhead receiver waters did not have appreciable effect upon the operation of the delayed coker. Considerable trouble was experienced since the unit startup with fouling of furnace tubes. This necessitated frequent shutdowns for furnace-cleaning operations.

Analysis of the coker charge, which is vacuum residuum during this period of fouling showed an alkalinity content as sodium hydroxide of 20 to 30 lb. per 1,000 bbl. At this time, the desalter operation was carrying a pH of 8.5 to 9.0 on the water outlet. By lowering this pH to 8.0 to 8.2, the alkalinity content of the coker charge was decreased to 1 lb. to 2 lb. per 1,000 bbl. as sodium hydroxide.

This decrease has practically eliminated the fouling problem. Desalting operations have improved in that emulsion problems are at a minimum and the extraction efficiency at a maximum.



PRETREATMENT SECTION of reformer showed considerable fouling before low pH operation was started. Fig. 5.

References

1. J. A. Biehl and E. A. Schnake, "Corrosion in Crude-Oil Processing—Low pH Vs. High pH," Proc. API **37 (III)** 129-34 (1957); The Oil and Gas Journal, May 20, 1957, p. 157.

2. Andrew Dravnicks and Horace A. Cataldi, "Industrial Applications of a Method for Measuring Small Amounts of Corrosion without Removal of Corrosion Products," Corrosion **10 (7)** 224-30 (1954).

3. W. T. Maddock and J. A. Biehl, "The Case of the Fouled Feed Preparation Unit," Petrol. Processing 98-101, Nov. (1956).

4. R. T. Effinger, M. L. Renquist, A. Wachter, and J. G. Wilson, "Hydrogen Attack of Steel in Refinery Equipment," Proc. API **31M (III)** 128-29 (1951); The Oil and Gas Journal, May 17, 1951, p. 99.

5. J. J. Hur, "Topic of the Month: 'Organic Inhibitors Improve Ammonia Control, Reduce Sulfide in Refinery Waste Waters,'" Corrosion **10 (2)** 1 (1954).

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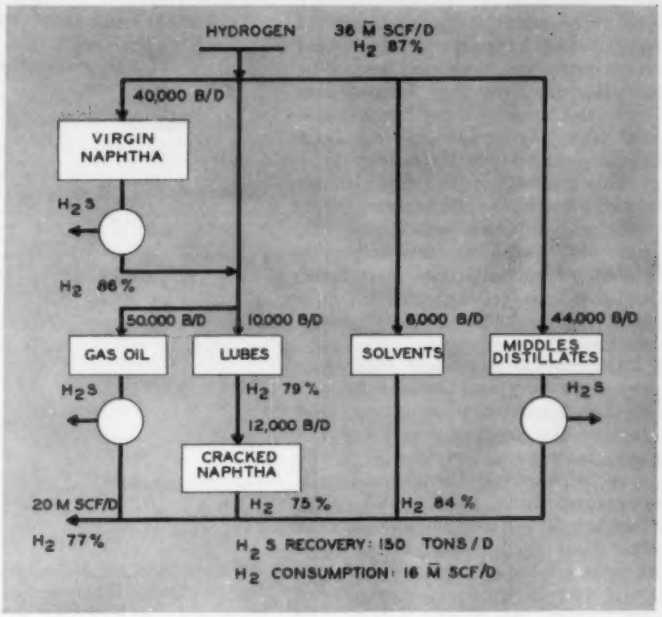

AN EXAMPLE of a suitable hydrogen-flow system for a typical group of integrated hydrogen-treating operations. Fig. 1.

How to get optimum use of byproduct hydrogen

in an integrated oil refinery

THE REFINER engaged in full-scale platinum reforming of virgin naphtha has adequate hydrogen available for hydrotreating all fractions of the crude charge.

This conclusion is the result of a detailed study of full-scale hydrogen treating of a well-integrated hypothetical refinery charging 100,000 bbl. per day of a typical high-sulfur crude. Hydrogen treating is applied stepwise to all primary fractions except the light ends.

And hydrogen treating is applied also to the heavy fractions of the naphtha and heating-oil products from catalytic cracking. It is also applied to these special products: lubricants, aliphatic solvents, and paraffin wax.

These treating steps consume about 70% of the hydrogen produced in catalytic reforming.

Paper presented at API midyear refining meeting, New York, May 27, 1959.

Humble's operations . . . The Baytown, Tex., refinery of Humble Oil & Refining Co. conducts complete hydrotreating operations except for treating wax (which the refinery does not produce) and asphalt.

High-sulfur crudes account for about 50% of the total crude charge. Hydrogen-treating capacity is about 55% of total crude charge. The combined operations consume about 50% of the available hydrogen from reforming.

The Process

Commercial hydrogen treating is conducted under relatively mild hydrogenation conditions. Economics dictate the use of low-pressure, low hydrogen-treat gas rate, and high oil space velocity, insofar as practicable for obtaining the desired results. Low temperature favors better catalyst-activity maintenance and less-frequent catalyst regeneration.

Conversely, the chemical reactions of hydrogenation are favored, within limits, by the reverse trend in these process variables. In general, hydrogenation becomes more difficult as the boiling point, or molecular weight, of the oil increases; hence more severe treating conditions are required for the heavier stocks than for the lighter fractions.

The range of process conditions for hydrotreating the wide variety of feed stocks may be listed as follows: temperature, 500° to 800° F.; pressure, 100 to 1,500 psig.; oil space velocity, 0.5 to 10 vol. per catalyst volume per hour; hydrogen treat rate 200 to 2,000 cu. ft. per bbl. Considerable study and experience are needed to define the optimal processing conditions for the individual feeds.

The catalyst . . . The hydrotreating catalyst most generally used for commercial operations is cobalt molybdate on alumina. A balance between activ-

ity, regenerability, and resistance to deactivation by sulfur, nitrogen, and trace metal contaminants has to be considered. A typical composition comprises about 3% of cobalt oxide and 10% of molybdenum oxide on a highly purified alumina base.

This catalyst is quite effective for desulfurization but is not very effective for hydrogenating aromatic ring structures under the relatively mild conditions normally used in commercial hydrogen treating; however, some condensed aromatic structures are hydrogenated.

The cobalt molybdate catalyst is regenerated by conventional methods to remove carbonaceous deposits. The regeneration frequency varies widely with feed stock and process conditions, primarily temperature. Typical operating cycle lengths are: virgin naphtha, 1 year; heating oil, 6 months; heavy gas oil, 2 months. Longer cycle lengths are sometimes obtained.

The over-all catalyst life usually is 1 to 3 years, depending again on feed and operating severity. In the catalyst regeneration, the air for carbon burning is diluted with either steam or inert flue gas. The use of steam usually is less expensive where regeneration is infrequent.

The hydrogen . . . The yield of by-product hydrogen from platinum reforming of naphthas usually is in the range of 500 to 1,100 std. cu. ft. per bbl. of feed. The yield varies with operating pressure, reforming severity, naphtha composition (crude-oil source), and boiling range of the naphtha.

A representative hydrogen yield is 500 to 750 std. cu. ft. per bbl., but with some feeds and with selected reforming conditions a hydrogen yield to 900 std. cu. ft. per bbl. is readily obtained. The hydrogen purity usually is in the range of 60 to 90%; a typical value is 80%.

The hydrogen purity from reforming with molybdenum oxide catalyst may be considerably lower, in the order of 50 to 70%. The diluent normally is light hydrocarbons, predominantly methane. A high hydrogen purity is very desirable since the hydrogenation reactions are related functionally to hydrogen partial pressure in the reactor. The only adverse effect of the light hydrocarbons is this dilution effect.

Hydrogen sulfide in the inlet hydrogen has a retarding effect on the desulfurization reactions. Hydrogen sulfide will be present when the by-product hydrogen is used in series flow for several successive hydrotreating operations.

If one or more of these hydrotreating operations are large hydrogen sulfide producers, it may be advantageous to remove the hydrogen sulfide (H_2S) from the hydrogen at an intermediate point with an amine scrubber. The recovered H_2S then can be converted by conventional methods to sulfur or to sulfuric acid for marketing.

In hydrotreating operations either once-through or recycle hydrogen flow may be used. Once-through hydrogen has the advantages of maintaining a higher hydrogen purity and eliminating the investment for the gas recycle equipment. With the moderate hydrogen-treat gas rates used in commercial hydrogen treating, most refiners engaged in platinum reforming on a full scale will have an adequate hydrogen supply for quite extensive hydrotreating operations based on once-through hydrogen.

Quality improvement . . . The major forms of quality improvement that are accomplished in hydrotreating various refinery stocks are listed in Table 1.

TABLE 1—QUALITY IMPROVEMENT FROM HYDROGEN TREATING

Virgin naphtha	Reduces sulfur, improves octane. Reduces corrosion and catalyst deactivation in subsequent catalytic reforming.
Cracked naphtha	Reduces sulfur, gum. Improves stability, oxidation resistance, and engine cleanliness characteristics.
Domestic heating oil, diesel oils, kerosine	Reduces sulfur, corrosion. Improves color, odor. Improves stability and burning characteristics.
Lubricating oils	Improves color, color stability. Reduces acidity.
Solvents	Improves odor. Reduces sulfur, corrosion.
Paraffin waxes	Improves color, odor, stability.
Gas oil, deasphalted oils	Reduces sulfur, carbon, nitrogen, metals, aromaticity. Lowers carbon yield and improves naphtha yield from cracking. Improves naphtha octane from cracking.
Residuum, asphalt	Produces more distillate products (gas oil, heating oil, naphtha) from crude oil. Improves quality of residual fuel oil.

Usually one particular quality aspect is the limiting factor in hydrotreating a given oil to obtain a product having the desired specifications. In the case of virgin naphthas, desulfurization is the most important factor; a typical hydrotreating operation will reduce the sulfur content of a naphtha reformer feed from 0.2% to 0.002 per cent or less. In hydrofinishing both virgin and cracked heating oils, the mercaptan content usually is the limiting product specification. Color can be a problem if the oils were poorly fractionated, particularly in the case of the cracked product. For heavy cracked naphthas, the test being used (such as optical density) to indicate sediment-forming tendency is normally the limiting specification. Color stability is the limiting property for both lubricating oils and waxes. Odor is the limiting specification for solvents.

Refining operating plan

A proposed schedule to illustrate the full-scale application of hydrogen treating to the operations of a well-integrated refinery has been developed and is presented in Table 2.

The example is based on processing 100,000 bbl. per day of a typical high-sulfur crude oil, such as West Texas crude oil. Hydrogen treating is applied stepwise to all primary fractions of the crude oil, except the light ends. Hydrogen treating is applied also to the heavy fractions of the naphtha and heating-oil products from catalytic cracking, and to the following special products: lubricants, aliphatic solvents, and paraffin wax. In the case of the cracked products, as indicated earlier, only the heaviest portion (approximately 25%) of these fractions requires hydrofinishing.

The yields from primary distillation of the crude oil used in this study are shown in the following tabulation:

Yields from Refinery Distillation of a Typical West Texas Crude Oil

	Per cent by vol. %
Light ends	0.8
Naphtha	25.5
No. 2 heating oil	11.3
Diesel oils	9.7
Gas oil	38.4
Residuum	14.3
Total	100.0

TABLE 2—HYDROGEN TREATING OPERATIONS FOR AN INTEGRATED REFINERY—HYDROGEN PRODUCTION AND CONSUMPTION

Basis: 100,000 bbl. per day of high-sulfur crude oil

	Oil charge 1,000 B/D	Hydrogen Yield: Std. cu. ft./bbl.	Hydrogen Yield: M.M.s.c.f.d.
Hydrogen Production—			
Platinum reforming of virgin naphtha	25.5	900	22.95
		Hydrogen Consumption: Std. cu. ft./bbl.	Hydrogen Consumption: M.M.s.c.f.d
Hydrotreating of Crude-Oil Distillates—			
Naphtha (for platinum reforming)	25.5	30	0.77
No. 2 heating oil	11.3	30	0.34
Diesel oils	9.7	30	0.29
Gas oil (for catalytic cracking)	38.4	200	7.68
Hydrotreating of Products from Catalytic Cracking—			
Depentanized:			
Light naphtha	10.4	...	...
Heavy naphtha	3.8	50	0.19
Heating Oil:			
Light	8.7	...	...
Heavy	2.6	50	0.13
Subtotal	91.3		9.40
Hydrotreating of Secondary Products—			
Heavy gas oil for catlytic cracking from deasphalting of residuum (60% yield on residuum)	8.6	200	1.72
Lubricating oils (from supplementary crude oils)	7.0	100	0.70
Aliphatic solvents (from supplementary crude oils	2.0	20	0.04
Paraffin waxes (from supplementary crude oils)	1.0	100	0.10
Total	109.9		11.96
Supplementary Hydrogenation Operation—			
Asphalt from deasphalting of residuum (for fuel products)	5.7	800	4.56
Grand total	115.6		16.52

Note: Total hydrogen consumed is 72% of available byproduct hydrogen.

Reforming . . . In the schedule presented in Table 2, all of the virgin naphtha from the crude oil is charged to platinum reforming, yielding about 23 M.M.s.c.f.d. of byproduct hydrogen. This hydrogen yield of 900 std. cu. ft. per bbl. is based on commercial experience, but is higher than some refiners currently are obtaining.

The various hydrogen-treating operations are then listed, showing volume of oil processed and the approximate hydrogen consumption. Hydrotreating of the distillate crude-oil fractions is listed first, followed by selected fractions from catalytic cracking. These operations are listed together because they probably are of the widest interest to the average refiner producing fuel products.

The hydrogen consumption for all these operations is shown to be 9.4 M.M.s.c.f.d. only 41% of the hydrogen available from crude naphtha. Hydrotreating of the heavy gas oil from deasphalting of residuum is shown as a secondary operation in the compilation because deasphalting of residuum for catalytic cracking feed is not at present widely practiced in the industry.

Hydrotreating of lubricants, solvents, and waxes is grouped with the secondary operations; hydrofinishing of these major special products is well established and is of wide interest. The inclusion of these secondary operations with the preceding hydrotreating operations consumes about 52% of the available hydrogen. It is assumed here that the refiner would be producing the lubricants, solvents, and waxes from selected crude oils, probably sweet crude oils.

The volumes shown for these products in Table 2 are estimates of probable maximum production, and are extraneous to the 100,000 bbl. per day of high-sulfur crude oil shown as being processed entirely to fuel products.

Asphalt . . . For completeness, hydrogenation of the asphalt fraction from residuum deasphalting is shown as a supplementary operation. This operation is feasible, but is not yet in commercial use. Asphalt hydrogenation for the purpose of conversion to lighter products is a high hydrogen consumer per unit of feed, relative to the preceding operations.

However, even when including asphalt hydrogenation, the total hydrogen consumption is only about 72% of the hydrogen available. Hence, in general, platinum reforming of the crude naphtha produces ample byproduct hydrogen for complete application of hydrogen treating to all fractions of the crude oil.

The order of preference in applying hydrogen treating step-wise to the various refinery stocks rests largely with the individual refiner and his specific problems. The proportion of high-sulfur crude oils being processed is an important factor.

Generally, hydrotreating of naphtha reformer feed is the first step. The finishing of specification products probably will be the next application, following the order in which product-quality problems are being encountered, or in which it seems expedient to retire outmoded treating equipment. Hydrotreating of gas oils then will be next in order.

Hydrogen treating at Humble

Humble conducts commercial hydrotreating operations to some extent on all of the oils listed in Table 2 except the paraffin wax and asphalt. Humble is not at present producing finished paraffin wax. High-sulfur crude oils comprise about 50% of Humble's total crude-oil processing, although this percentage varies from time to time.

Humble's hydrogen-treating capacity at present is about 55% of its total crude-oil charge. The types of oils and approximate volumes now being hydrotreated by Humble are listed in in Table 3. These operations consume about 50% of the byproduct hydrogen that Humble has available.

Hydrogen utilization . . . For the optimal utilization of byproduct hydrogen in the refinery, it is desirable to have dual naphtha reforming units so that a partial hydrogen supply can be maintained during a down time at one of the reformers. When the hydrogen supply is reduced temporarily in this manner, the refiner usually will find it advantageous to maintain the normal oil-charge rates to the hydrotreating units while reducing the amount of gas used for hydrogen treating.

The permissible reduction in hydrogen-treat gas rate varies for different operations. A reduction in the hydrogen rate reduces the treating effec-

tiveness somewhat and may shorten the operating period before catalyst regeneration is needed.

These objections usually are offset, however, by the advantage of maintaining normal stream production rates. In some finishing operations where quality specifications are quite critical, it may not be possible to tolerate the temporary reduction in hydrogen-treat rate.

It is evident, however, from Table 2 that the refiner engaged in platinum reforming will have ample hydrogen for extensive hydrotreating operations, even when the hydrogen supply is curtailed temporarily by as much as 50%.

For the most effective use of the hydrogen supply in multiple hydrotreating operations, it is desirable to establish a balance between parallel and series flow to the various treating units.

Parallel flow, insofar as it is practicable with the available hydrogen supply, favors maintenance of the desired high hydrogen purity at the individual units.

Series flow permits keeping more of the treating units on stream during periods of restricted hydrogen supply. In series flow the treating units for which a high hydrogen purity is most important, and for which the hydrogen consumption is relatively small, should be placed at the front of the hydrogen train. In general, units requiring similar volumes of gas for treating should be located in the same train. When some of the hydrogen-treating operations require higher pressures than others, the flow should be arranged to utilize the available hydrogen pressure to the best advantage.

In the interest of maintaining high hydrogen purity and low H_2S concentration in the flow system, it may be desirable to install amine scrubbing facilities on the tail gas from individual units where the hydrogen sulfide production is large.

Other credits for recovering this hydrogen sulfide have been mentioned. It has been found advantageous to provide appropriate piping and valves to permit some flexibility between parallel and series hydrogen flow to the several treating units.

Hydrogen flow . . . An example of a suitable hydrogen-flow system for a typical group of integrated hydrogen-treating operations is shown in Fig. 1. This system is similar to that now being employed commercially by Humble. Such a flow plant would be modified, of course, to fit individual requirements.

The plan in Fig. 1 includes operations on virgin naphtha, lubricants, solvents, cracked naphtha, heavy gas oils for catalytic cracking, and middle distillates. The middle distillates might include domestic heating oil, kerosine, and diesel oils. These stocks might be processed in series or as part-time separate operations in a single unit.

Hydrogen sulfide is scrubbed from the hydrogen tail gas at several points. The concentration of hydrogen in the gas stream is indicated at various points in the system. The byproduct hydrogen from platinum reforming at Humble, because of the low-pressure reforming operation, contains 87% of hydrogen.

The exit gas from the system contains 77% of hydrogen. Hence, despite the extensive treating operations, the hydrogen purity remains fairly high for possible subsequent use. The total hydrogen consumption is 17 M.M.s.c.f.d., representing about 51% of the hydrogen available.

In this particular example, 150 tons per day of hydrogen sulfide is recovered. Again the adequacy of the by-product hydrogen yield for conducting a multiplicity of treating operations is illustrated.

TABLE 3—Hydrogen Treating at Humble Oil & Refining Co.

Refinery crude-oil charge, bbl. per day	295,000
Per cent high-sulfur crude oils in total crude-oil charge	54.3
Hydrogen-treating operations, bbl. per day	
Naphtha for platinum reforming	40,000
Heavy cracked naphtha	12,000
Virgin and cracked middle distillates	44,000
Gas oils for catalytic cracking (includes deasphalted oils)	50,000
Lubricating oils	10,000
Solvents	6,000
Total hydrogen treating, bbl. per day	162,000
Hydrogen-treating capacity, per cent of total crude-oil charge	55
Byproduct hydrogen available, M.M.s.c.f.d.	32
Hydrogen consumption, M.M.s.c.f.d.	16
Hydrogen consumption, per cent of available hydrogen	50
Hydrogen sulfide recovered, tons per day	150

Processing of individual feeds

Hydrogen treating of naphthas and middle distillates is practiced widely in the industry and needs no further discussion. The processing of solvents is straightforward. Hydrotreating of heavy gas oils and lubricating oils are new operations on which additional comment is of general interest. The treating of paraffin waxes is conducted under conditions similar to those used for the lubricating oils.

Gas oils . . . Heavy gas oils can be treated with hydrogen under relatively mild conditions to improve their quality and value as catalytic cracking feed. Typical results for this type of process are available from commercial operations conducted by Humble.

Humble's feed to gas-oil hydrotreating contains about 35% of heavy deasphalted oil extracted from vacuum residuum with a propane-butane solvent. The inspections on a representative feed are listed in Table 4; the high boiling range of the feed is noteworthy. The major improvements with respect to cracking quality that are effected in such a feed by mild hydrogen treating also are shown in Table 4.

The principal effects of hydrotreating on the subsequent catalytic crack-

TABLE 4—Hydrotreating of Heavy Gas Oil for Catalytic Cracking

Feed: 65% high-sulfur gas oil 35% deasphalted oil	
Feed inspections:	
Gravity, ° API	20.9
Viscosity (Saybolt Universal) at 210° F. sec.	64
Sulfur, % by weight	1.8
Conradson carbon, % by weight	2.4
Nitrogen, % by weight	0.1
Nickel, p.p.m.	0.4
Vanadium p.p.m.	0.4
ASTM distillation, ° F:	
20% point	743
50% point	888
80% point	1,060
	(Per cent)
Quality improvement from processing:	
Sulfur removal	70 to 80
Conradson carbon reduction	40 to 50
Metals removal	60 to 70
Nitrogen removal	20 to 30
Aromatics reduction	10 to 20

Coming: Special Report on World Oil Congress

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A BILLION-POUND BACKGROUND in Engineering Ethylene Plants

Leading oil and chemical companies on both sides of the Atlantic testify to the Kellogg Organization's ability to engineer ethylene manufacturing and recovery plants. The twelve for which Kellogg has been responsible to date represent an annual capacity in excess of 1,050,000,000 pounds!

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ing operation are indicated in Table 5. These figures are typical, but will vary for different feeds and processing conditions. The basic credits for hydrotreating result from an increase in naphtha octane quality, an increase in naphtha yield, and a decrease in carbon yield.

From an economic standpoint the naphtha octane increase at high level on a large-volume gasoline component is particularly significant. Since the capacity of most catalytic cracking plants is limited by carbon-burning capacity in catalyst regeneration, advantage can be taken of the lower carbon yield following hydrotreating to either: (1) increase oil charge rate to the catalytic cracking plant; or, (2) operate the cracking plant at a higher conversion level.

Based on producing a deasphalted oil of specified Conradson carbon content for catalytic cracking, the oil yield from the residuum in a typical example might be increased from 50 to 60 to 65% when employing hydrotreating. Substantial economic credits are associated with this recovery of additional cracking stock from the crude oil.

Table 5 also presents a typical example of the major effects of gas-oil hydrotreating on the refinery-wide product yields. The principal net effects are an increase in premium-grade motor gasoline and a reduction in residual fuel oil.

TABLE 5—Catalytic Cracking of Hydrodesulfurized Gas Oils

(At 50% 430° F. + Conversion)	
Carbon yield decrease, %	20 to 25
Naphtha yield increase, %	5 to 10
Naphtha octane increase:	
ASTM octane number (D 908, Research Method), with addition of 3 ml. TEL per gal.	1.5
ASTM octane number (D 357, Motor Method), with addition of 3 ml. TEL per gal.	2.8

Major Effects on Refinery-Wide Yields
(Based on 50,000 B/D hydrotreated gas oils)

	(B/D)
Premium motor gasoline	+2,540
No. 2 heating oil	+ 130
Butanes	+ 950
Butylenes	+ 280
Residual fuel oil	—3,225

Lubricating oils . . . Hydrogen treating can be used to advantage for improving the color and color stability of most lubricating oils, including some bright stocks. Specification products are produced without the use of acid or clay treating. Neutral oils are produced from naphthenic-base crude oils in this process.

A high degree of desulfurization is not desired in lubricating-oil hydrotreating because some of the sulfur compounds function as inhibitors to sludge formation when the oil is exposed to oxidizing conditions. Typical results obtained in hydrotreating a lubricating-oil base stock are presented in Table 6.

TABLE 6—Hydrotreating of SAE 30 Extracted Lubricating-Oil Base

	Feed	Product
Color, Tag Robinson	6¾	21¼
Colorhold (16 hours at 212° F.), Tag Robinson	4¼	19¾
Neutralization No., Mg KOH per 100 ml.	1.6	0
Conradson carbon, % by weight	0.04	0.02
Sulfur, % by weight	0.19	0.08
Pour, °F.	20	25
Viscosity (Saybolt Universal) at 210° F., sec.	66.5	65.5
Gravity, ° API	28.1	28.3

Other Articles

"Journal Survey of Refineries in the United States," The Oil and Gas Journal, 56 [12] 159-206 (1958).

"World-Wide Oil Report," The Oil and Gas Journal, 55 [52] 121-50 (1957).

J. E. Lawson, J. P. Peet, and N. P. Peet, "Get More Cracker Feed From Residue," Petrol Refiner 38 [3] 177-80 (1959).

G. T. Gwin, R. L. Heinrich, E. J. Hoffman, R. S. Manne, H. W. H. Meyer, J. R. Miller, and C. L. Thorpe, "Hydrogenation of Asphalt for Fuel Products," Ind. Eng. Chem. 49 [4] 668-72 (1957).

E. H. Lewis, "Hydrofining Catalytic Cracking Feed Stocks," The Oil and Gas Journal, 54 [11] 95-6 (1955).

Dr. W. A. Jones, "Hydrofining Improves Low-Cost-Lube Quality," The Oil and Gas Journal, 53 [26] 81-4 (1954).

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Small semiautomatic pilot plants

. . . guide refinery operations at Tidewater's Delaware and Avon plants. Their data make it possible to obtain accurate yields and product properties from individual feed stocks or mixtures of known origins.

BY W. M. MILLER
Tidewater Oil Co.

PILOT-PLANT DATA provide a valuable source of useful and reliable information for planning and controlling refinery operations at the Avon and Delaware refineries of Tidewater Oil Co. By comparison, run data taken from refinery unit log books may often be inaccurate or of dubious value for the following reasons:

1. The composition of the charge to crude-oil units often is not accurately known, because of storage limitations and other reasons.
2. Intermediate streams, such as gas oils and naphthas, become commingled in an extremely complex manner in the refinery and make it virtually impossible to determine the composition of the charge to downstream processing units.
3. The complex interrelationships among the various processing units result in operating changes at one unit affecting the operation of other units down the line. This means that static operating conditions on a unit for any prolonged period of time are rare.
4. Accurate yield data are next to impossible to obtain from those units which are tied in with gas plants serving several units.
5. Temperature, pressure, and flow-recording instruments at the refinery units usually have greater calibration errors than do laboratory meters, so that operating conditions and flow rates are not known precisely. In many cases, some of the streams are not even provided with meters, making it necessary to obtain the volume of these streams by difference.

Operation guides . . . Pilot-plant data provide the basis for guiding many of the Avon and Delaware refinery operations. Chief among them are:

1. Planning and forecasting refinery operations.
2. Long and short-range economic studies.
3. Checking guarantee yields on new refinery installations.
4. Determining causes for unsatisfactory yields in commercial units.
5. Determining optimum operating conditions.
6. Recommending changes in operating procedures.
7. Selecting new processes.
8. Sizing new refinery equipment and modifying old equipment.
9. Special investigations.

Planning Refinery Operations

Starting with the crude-oil input data and the use of crude-oil analyses together with pilot-plant yields of products from catalytic cracking, fluid coking, hydrodesulfurizing, and catalytic reforming, along with test-run data on other units within the refinery, a forecast can be made of the volumes of all products to be manufactured at the refinery.

In addition, much information concerning the quality characteristics of these products is accurately determined in advance. For example: volatility, vapor pressure, and octanes of premium and regular grades of motor gasoline, as well as the sulfur content of diesel and residual fuel oils, and certain other properties of products which have to meet specifications are forecasted.

Computer work . . . To make an accurate forecast by processing a mixture of several crude oils through the various refinery units, on paper, requires a number of man-days and countless mathematical calculations.

To reduce the time element and the amount of work, these production forecasts and budgets are now done on an IBM 650 machine. The electronic data-computer programs used in this work include mathematical models of the various units within the Avon and Delaware refineries and can be made to simulate different types of refinery operations by changing the instructions and input data to the individual models within the program.

These mathematical models were constructed from pilot-plant data and the effect of various operating variables on yields and product properties as determined from pilot-plant runs.

Reliable results . . . It has been found that the use of pilot-plant data in the refinery-simulation program gives more reliable results than attempting a correlation of yields from average feed-stock properties. Fortunately, considerable data had been accumulated in the Avon pilot plants prior to developing the computer program. In the case of catalytic cracking, data are available on virgin gas oils from more than 45 different crude oils. As new pilot-plant data become available, the IBM 650 program can be easily revised without disturbing its sequence.

In setting up the computer program for processing mixtures of several different feed stocks through a unit, it was assumed that each feed stock would react (crack in the case of cata-

Paper presented at A.P.I. midyear refining meeting, New York, May 28, 1959.

Congrats and $25 to Doug Foster, Atlantic Refining Co., Dallas, Texas

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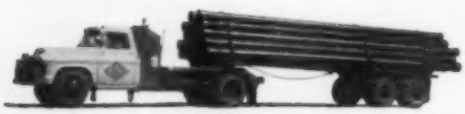

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lytic cracking) in a mixture as if it were being reacted by itself at the same severity of operation selected for the mixture.

To prove the validity of this assumption, a study was made in our catalytic cracking pilot plant on several feed stocks and a known mixture of the same stocks in which all the operating variables were held constant except for the weight hourly space velocity. From these tests it was observed that at a given weight hourly space velocity (severity), each of the stocks cracked at different conversions.

However, when the yields at these different conversions on the individual stocks were added together in their proper proportions, the combined yields were in close agreement with those obtained on the mixture.

Selection of crude oils for a refinery depends on a number of factors, of which the cost, yields, and properties of the products produced are of vital importance. The oil purchase and exchange department of our company relies on results from the refinery-simulation program for estimates of the margin of profit from individual crude oils in making decisions on which crude oil to buy or exchange. Without crude-oil analyses and pilot-plant yields, a margin estimate would be no better than a guess.

Economic studies . . . Pilot-plant data have been invaluable in making economic studies for long-range projects such as refinery expansion to meet increases in forecasted sales volumes, modernization of old equipment, and installation of new equipment to upgrade marginal products and meet changing product specifications.

Short-range economic studies, such as utilizing idle unit capacity for processing oil for other companies, increasing the capacity of existing units by the use of untried processing ideas, and reducing chemical usage through installation of new equipment, have been based on pilot-plant data.

The licensor of a new process unit at Avon recently used the results from one of the Avon pilot plants to determine whether the new commercial unit met its yield guarantee.

Unsatisfactory yields . . . There have been a number of cases in which our pilot plants have been used to determine the cause of unsatisfactory commercial yields. In one of these cases it was found that the gasoline yield was lower after the turnaround of a catalytic cracking plant than before shutting down the unit. Pilot-plant tests revealed that a change in quality of the feed was responsible for

the lower yields and that nothing was physically wrong with the unit or the catalyst.

A pilot-plant study was undertaken to determine what cut point should be used at the feed-preparation vacuum stills to produce the greatest total value of net products from catalytic cracking plus fluid coking. This work not only determined the optimum cut point but also the breakeven cut point for starting up a second feed preparation still when the metals content of the virgin gas oil limited the throughput of the first unit.

Changes in operating procedures . . . Tests were made in our catalytic reforming pilot plant on samples of catalyst taken from each reactor at the end of a commercial reformer run. From this work it was recommended that in the future the process department maintain the first reactor at maximum severity and operate the third reactor at a lower severity throughout the run. This practice has now been accepted in the refinery.

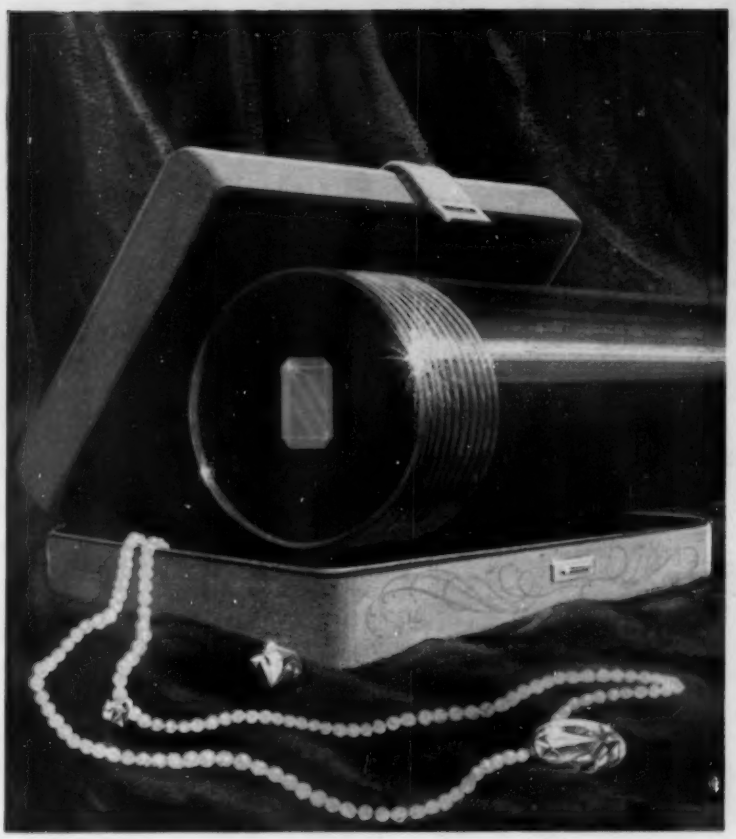
Another example was a fluid-coking pilot-plant run on catalytic decanted gas oil. This was being run in the commercial fluid coker to improve its catalytic cracking characteristics. The pilot-plant tests disclosed that fluid coking reduced the carbon residue but did not improve the catalytic cracking yields from this stock.

On the basis of this and the insignificant amount of cracking that occurred to it during fluid coking, it was recommended to eliminate the fluid coking of this stream. It would have been extremely difficult and expensive to determine this in commercial units.

Pilot plants usually are not used at Avon to develop new processes. However, in some cases these small pilot plants have been used to evaluate existing new processes. Examples of this are the selection of the new fluid-coking process and the selection of mild reforming plus solvent extraction.

Sizing equipment . . . The Avon engineering department uses pilot-plant data in checking the basic designs of proposed new installations. For instance, in checking the design of a desulfurization plant the proposed charge stocks are first run in the pilot plant and data obtained on the operating conditions required to meet the desired nitrogen and sulfur contents of the products. From this information, the engineering department determines the size of compressors, heat-exchange equipment, fired heaters, towers, vessels, and other related equipment for a commercial unit.

Pilot-plant data were used with ex-



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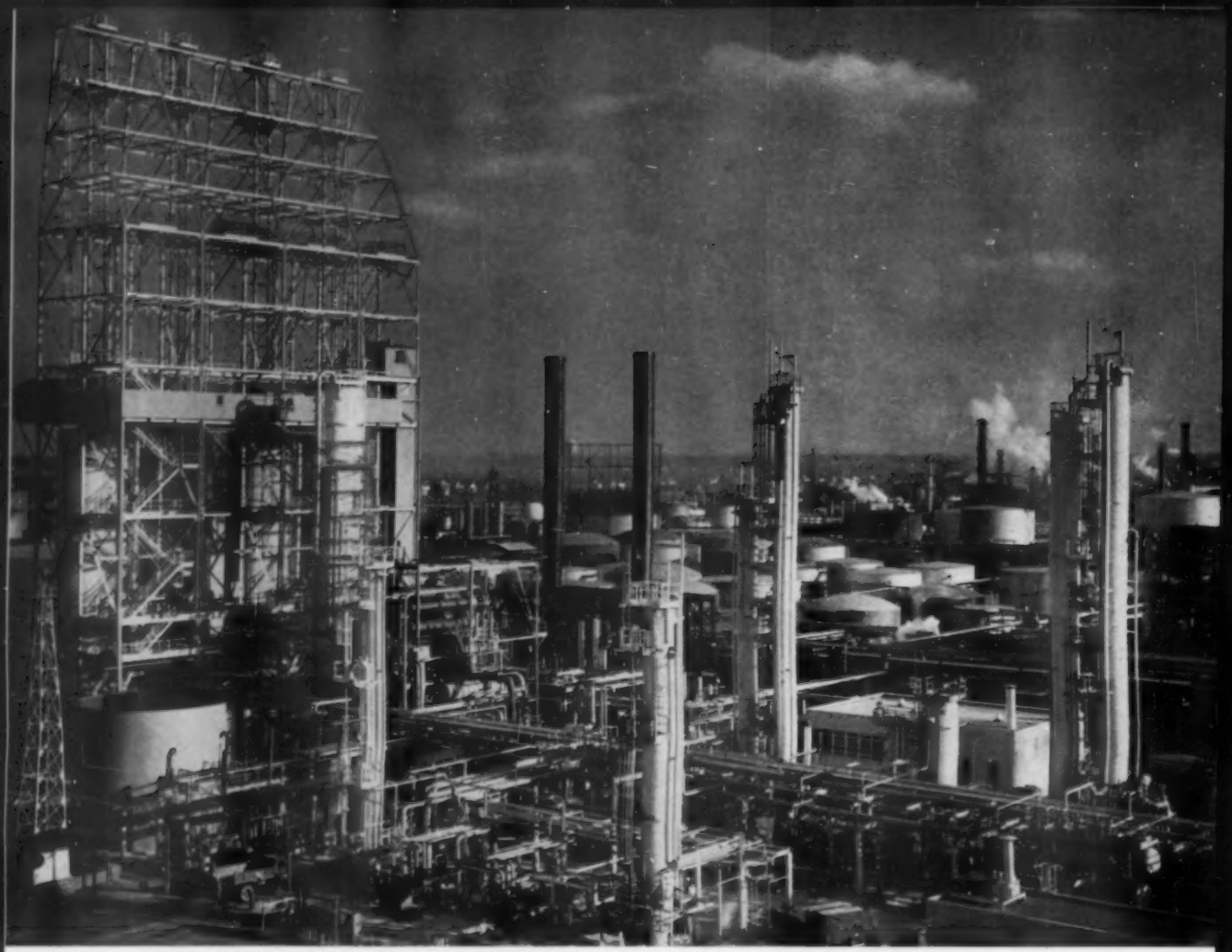

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unit feeds mixture of 7 stocks including Furfural Extract, Duosol Tar and Propane Deasphalting Tar

The new 19,000 B/D Delayed Coking Unit – designed, engineered and constructed by The Lummus Company for Mobil Oil Company at their Paulsboro, New Jersey refinery – is on its initial run.

The coker, comprising 4 coke drums 19 feet in diameter by 63 feet tangent to tangent, is designed for 764 tons per day of coke, making it the largest initial capacity coker ever built in the United States.

The feedstocks are various reduced crudes or blends of residua whose gravity varies from 3 to 14° A.P.I. These charge stocks may be blended with up to 25% of furfural extract.

The unit cokes the heavy residual stocks withdrawn from other refinery units which previously were blended into fuel oil. The coker makes seven products: fuel gas, butane-butylenes, light and heavy gasolines, light and heavy gas oils, and coke.

In addition to the coking section, the unit includes: a gas recovery section, sulfuric acid treater for gasoline, amine treater for light hydrocarbons, and a caustic treater for the butane-butylene stream.

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cellent results in determining the required equipment changes for the expansion of the Avon fluid catalytic cracking unit from its original 16,000-bbl. per stream-day to the present 50,000-bbl. per stream-day capacity. Product distribution and yields of the expanded unit equal those predicted from pilot-plant data.

Before any new catalyst is accepted for use in our Avon and Delaware refineries, it is approved by the Avon research and development department. New desulfurizing and reforming catalysts are compared with other commercially available catalysts in the pilot plants under a given set of operating conditions. Desulfurizing catalysts are rated primarily on their activity for removing nitrogen.

Reforming catalysts are rated on the basis of the yields at three different octane levels and the reactor inlet temperatures required to attain these octanes. Activities of spent and regenerated desulfurizing and reforming catalysts are determined from time to time.

A special technique is used for evaluating cracking catalysts. New cracking catalysts are aged for 600 hours in our catalyst activity decline testing unit under simulated plant conditions and product distribution runs are made on the aged catalysts. Yields at a given conversion are then compared.

Evaluation of crude production . . . Crude oils from new zones and new fields of interest to the company frequently are processed through laboratory distillation equipment and the pilot plants in a manner similar to the way they would be processed in the refinery, and comprehensive reports are issued on their yields and product properties. These data are used in the computer program for evaluating new crude oils.

New processing schemes . . . The pilot plant provides an excellent means of trying out new processing schemes. An example of one of these schemes was to catalytically crack the butane-butylene stream from the fluid coker to reduce the high butadiene content of this stream. Pilot-plant tests showed that catalytic cracking of the coker butane-butylene stream under normal conditions along with gas oil effects a removal of 92% of the butadiene and that the liquid recovery of the coker butane-butylene fraction of the feed was approximately 95%. As a result of this investigation, this stream is now being processed in the catalytic cracker with the yields as predicted.

Sometimes proposed processing schemes do not prove so successful,

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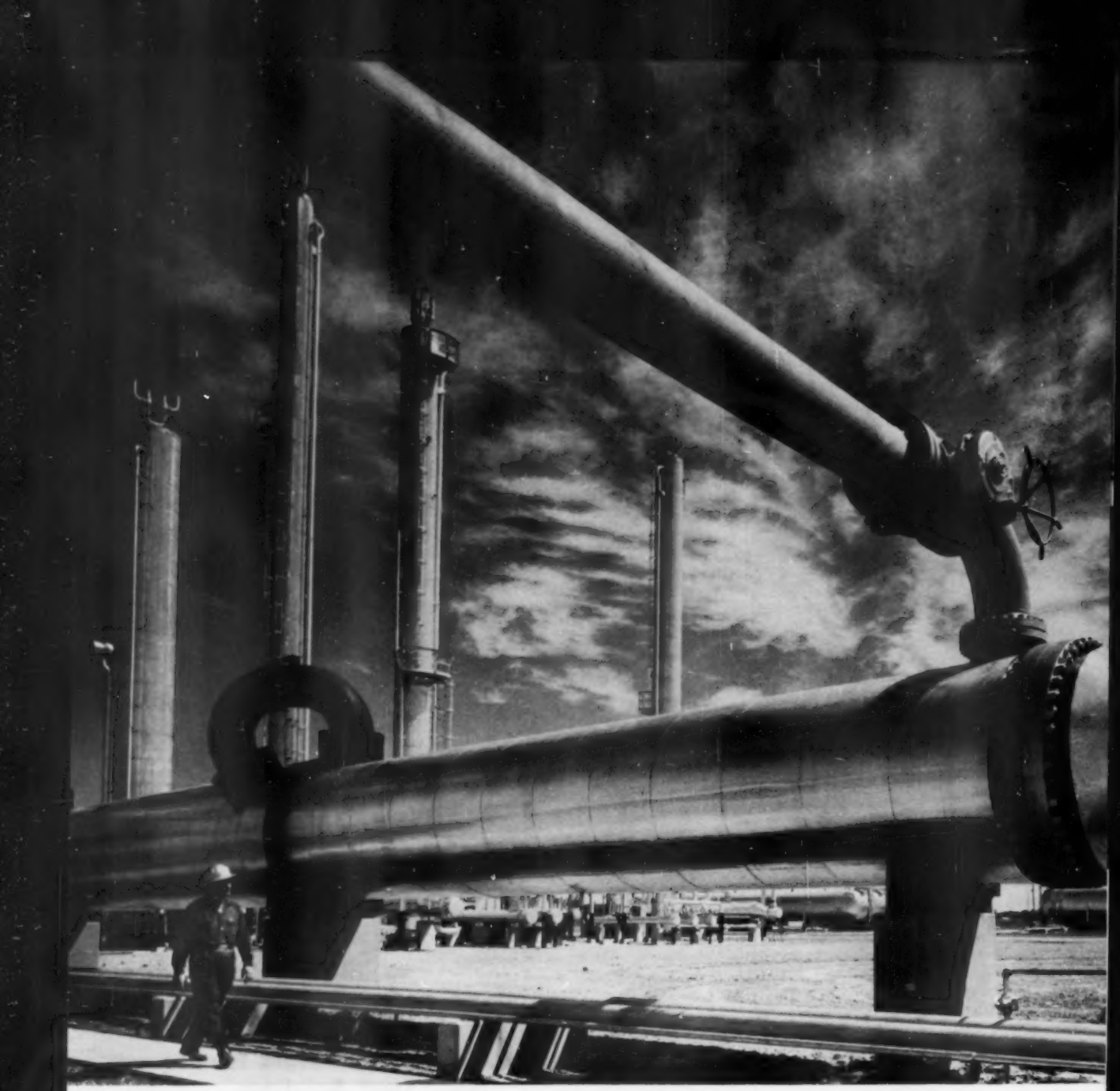

The extraction plant of Runnels Gas Products Corporation at Eunice, La., processes more than 300 mmcf. of pipeline gas daily to yield 5,000 barrels of liquid hydrocarbons (all the natural gasoline and butanes, 96% of the propane and 35% of the ethane.) Fuel-gas consumption is less than 3%. Absorption takes place at -40°F.

What's new in gas processing?

Anyone contemplating construction of a natural-gas processing plant, whether its purpose is treating, extraction or a combination of both, must first solve a puzzle with three complex variables. The efficiency and profitability of the plant depend on how well the puzzle is solved.

The first variable is, of course, the volume and composition of the inlet gas stream. The second is the market, if any, for extracted products, and the third is the legal and technical requirements for residue gas.

Major shifts in these variables make it profitable today to design gas-processing plants that differ radically from those built only a few years ago, and to locate them much farther away from the gas fields.

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For example, it is now advantageous to build large, highly efficient extraction plants to handle great volumes of lean Louisiana gas. Such plants serve the tremendously expanded LPG market for butanes and propane, and the petrochemical market for both of these, plus ethane. Because of the volume of gas, and the degree of extraction desired, a combination of extreme cold and light-oil absorption is the most efficient way to get the marketable hydrocarbons out. Refrigeration costs are more than offset by the use of smaller quantities of lighter oil, with consequent savings in pumping and stripping capacity.

As the natural-gas industry mushrooms, the trend is toward large plants, not only for hydrocarbon extraction but for sour-gas treating as well. And as the plants grow bigger, new levels of efficiency can be reached through methods that were impractical in smaller installations.

The development of new techniques for large-volume gas processing has been a Fluor contribution to the industry. The combined experience of the gas specialists in Fluor's Los Angeles and Midcontinent divisions represents a pool of advanced know-how that is unequaled anywhere.

The Fluor brochure, "Opportunities in Gas Processing," will be helpful to anyone planning construction of a processing facility. Write to Dept. 67, The Fluor Corporation, Ltd., 2500 South Atlantic Boulevard, Los Angeles 22, California.

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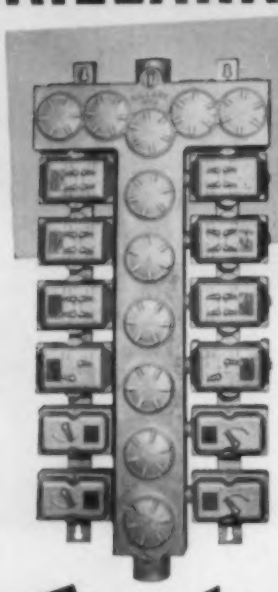

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but the cost of trying them out in small pilot plants similar to those at Avon is minor when compared to commercial-scale tests. The pilot plant can, therefore, be used to screen out those ideas which, if unsuccessful in the pilot plant, would most likely stand a poor chance of working out satisfactorily in the refinery.

The Pilot Plants

The four small semiautomatic pilot plants and the catalyst-activity decline testing unit which furnish the data used in guiding refinery operations were built and are operated especially for this purpose. With this idea in mind, extra care was taken in their design in order to permit the important commercial operating variables to be duplicated in these small units so that the yields and product properties would correlate well with those obtained commercially.

An example of the excellent correlation between the catalytic cracking pilot plant and the Avon catalytic cracker has been mentioned in another paper. Correlations on the other units with their respective commercial plants also have been quite close.

To reduce the cost of operating these units, they were made small in size and were designed to run with a minimum of attention. Two of the units are believed to be unique in the oil industry in that they run unattended 16 hours a day. To accomplish this type of operation, more than the usual amount of automatic controls and safety devices found in most pilot plants are used.

In describing these small pilot plants and catalyst-activity-decline testing unit special emphasis is placed on their automatic features.

Reforming Pilot Plant

The Avon catalytic desulfurizing and reforming pilot plant was completed in July 1954, and to date 1,500 successful runs have been made on it without accident even though the unit runs unattended 16 hours per day. Residua boiling as high as 990° F. at the 50% distillation point have been hydrogenated at 1,000 psig. in this unit with no attention.

The pilot plant consists of two identical units housed in a fireproof transite enclosure 5 ft. wide, 9 ft. long, and 10 ft. high. Each unit is capable of charging 100 to 1,000 ml. per hour of hydrocarbon feed. Operating pressures range from 300 to 1,000 psig., reactor temperatures from 300° to 1,000° F., and catalyst quantities from 15 to 250 ml.

The reactors are 1 in. in diameter by 55 in. in length, and are heated in aluminum-bronze block assemblies.

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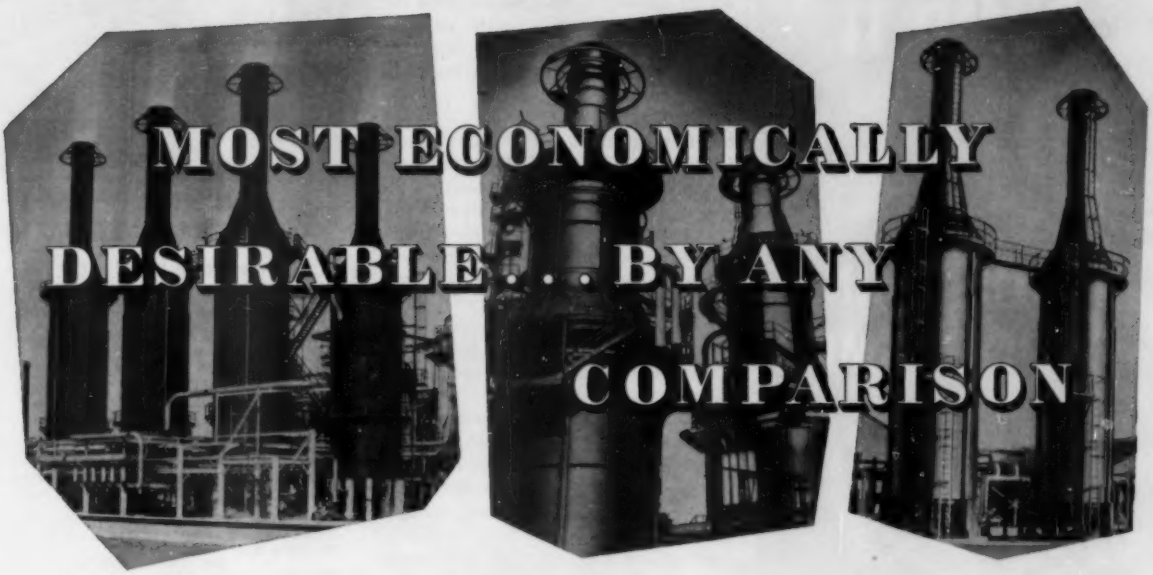

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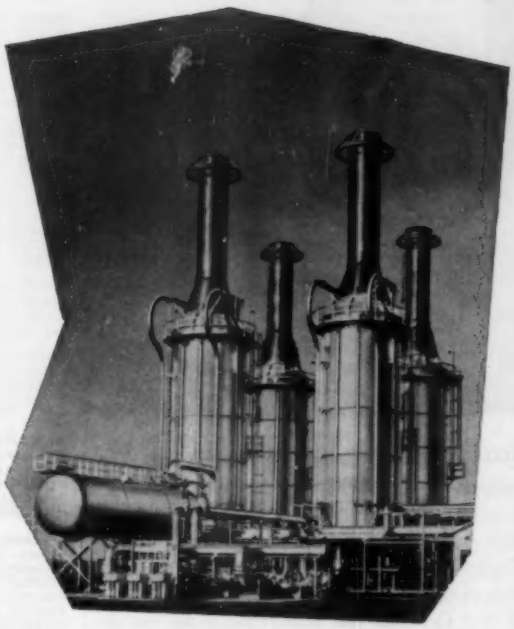

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Each unit has its own feed tank, feed pump, reactor, high-pressure separator, debutanizing tower, refrigerated cooling system, and a gas compressor which recycles hydrogen gas from the high-pressure receiver to the catalyst. Hydrogen consumed during desulfurization is supplied from a cylinder of hydrogen.

Safety measures . . . For safety during unattended operation, all parts of the pilot plant, with the exception of the gas meters, panel-board instruments, and gas cylinders, are located inside the fireproof enclosure. Because of the wide explosive range of hydrogen, a ventilating suction blower, located above the enclosure, changes the air within the housing once a minute and exhausts it through the roof of the main building.

Spaced around the ceiling of this enclosure are four spray nozzles through which carbon dioxide (CO_2) would be discharged into the chamber if a thermostat should reach a temperature of 160° F. The sudden rush of the CO_2 through the line to the nozzles operates two pressure switches; one shuts down the pilot plant and suction blower, and the other rings an alarm in the nearby physical laboratory where men are on duty 24 hours a day.

Should the unit be automatically shut down for any reason except fire during unattended periods, a solenoid valve in the hydrogen supply line opens and allows a small flow of hydrogen to sweep the feed off the catalyst.

A mercoid pressure switch on each unit shuts down the feed pumps and compressors in case of an abnormal increase or decrease in pressure. Bursting disks vented to the outside of the building provide additional protection.

Should something happen to cause a temperature higher than 1,175° F. within the unit, a limit switch on the temperature recorder shuts down the whole unit.

Should the solenoid valve on the outlet of the high-pressure separator fail and the liquid begin to rise in the separator, a time-delay relay working in conjunction with a capacitance-type liquid-level control relay will shut down the unit after a period of 30 seconds.

Gas leaving the hydrogen recycle compressor passes through an electrically heated section of tubing with resultant increase in temperature. A thermocouple in the gas stream a few inches from the heated section indicates a temperature varying directly with flow. Since the section of tube where the thermocouple is lo-

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cated is heated only by the hot gases flowing through it, any decrease in flow will result in rapid cooling of the thermocouple. This temperature drop is used to operate a contact temperature relay to actuate an alarm and shut off both feed pumps and compressors when the hydrogen circulation stops.

Two double-pole relays are used for over-all control of the system. One relay, whose contacts control coil current for all the other relays, is actuated only by the high-temperature switch on the temperature recorder or by closure of the fire-control thermostat. This relay will turn off all heaters and motors of the unit. A second relay, actuated by high or low pressure, or by the hydrogen flow indicator, will shut down the pumps and compressors but leave the heat on the unit.

Automatic gas-sampling . . . Each unit is provided with an automatic gas-sampling apparatus which consists of two 250-ml. standard glass gas-sampling bombs, a gas-confining solution reservoir, a vertical threaded shaft driven by a small motor, an interval timer, and limit switches. In practice, the reservoir is lowered by the threaded shaft from a position above the gas-sample bombs to a position below, allowing composite samples of the product gases to be drawn into the bombs as the gas-confining solution in the bombs is drained off.

The sampling time is set by the timer. Cam-operated limit switches stop the motor after each revolution of the shaft. At selected intervals the timer momentarily shorts the limit switch allowing the shaft to make another revolution. This occurs 360 times to completely drain the bomb, giving, in effect, 360 spot samples in any selected total time.

Additional controls are being installed on this unit to permit weight-balance runs to be started automatically during the night.

Cracking Catalyst Activity Tester

As originally designed, the testing unit was a fixed-bed reactor for aging pelleted catalysts. In 1953 it was converted to a fluidized fixed-bed reactor for aging catalysts screened to 60-200 mesh. A typical aging run on the present unit requires 6 weeks' time, 15 gal. of catalytic cracker charge stock, and 300 g. of screened catalyst.

The operation is cyclic and is repeated every 30 minutes 24 hours a day, until the catalyst is aged 600 hours. The normal temperatures are 965° F. for reaction and 1,150° F. for regeneration.

The testing unit is housed in a fireproof transite enclosure 4 ft. wide, 8 ft. long, and 10 ft. high, and is equipped with automatic fire-protection and shutdown equipment similar to that used in the desulfurizing and reforming pilot plant.

The main equipment inside the enclosure consists of a feed tank, a gear pump which pumps 12 ml. per minute of feed during the reaction cycle, two positive-displacement water pumps for supplying the dispersion and stripping steam, a feed preheater, a vessel in which the reaction and regeneration take place, and a product-handling system which includes a refrigerated water knock-back condenser and a debutanizing column.

The reactor regenerator vessel is about 30 in. long and is made of 1½-in. pipe with a 4½-in.-long, 3-in.-diameter expanded section at the top. This vessel is stainless steel and is lined with a 0.01-in.-thick coating of alumina to prevent rusting. The filter inside the vessel used to confine the catalyst is made of porous porcelain. The stainless-steel filter previously used caused nickel poisoning of the catalyst samples and made the results inconsistent from one run to another.

A program cycle timer with 12 cams operates the unit. It controls the flow of feed and dispersion steam during the 2.86-minute reaction cycle, steam during the 90-minute stripping cycle, air during the 10.00-minute regeneration cycle, and nitrogen during the 13.24-minute purge cycle.

In doing this, the program timer opens and closes, in sequence, the magnetic and air motor valves, as well as starting and stopping feed and water pumps. The cycle timer also regulates the regeneration temperature by introducing an adjustable external resistance in the measuring circuit of the reaction temperature controller.

It automatically controls the pressure at 18 psig. during regeneration and at atmospheric pressure during all the other cycles by operating a bypass valve around a pressure-regulated valve.

The reactor and feed lines are protected from excessive pressures by mercoid pressure switches which shut the unit down. Bursting disks on the reactor and feed line provide additional protection.

A connection on the product line directly before the dehydrator leads to another manometer. It is possible for the calcium sulfate drier or wet-gas condenser to plug up and raise the back pressure on the glass debutanizer column to a point where it could break. To prevent this condition, the mercury manometer closes an electrical circuit when the pressure reaches 6 psi.

A reset relay is then energized which shuts off the power to all parts of the unit except the temperature recorder. Simultaneously with the shutting down of the unit, a solenoid valve opens and releases the pressure on the dehydrator to a vent line.

Should something happen to cause a temperature higher than 1,175° F. within the unit, a limit switch on the temperature recorder shuts down the unit.

The Midget catalytic cracking plant[3] is used primarily for evaluating feed stocks but also is used to study operating variables. The normal operation is once-through but also can be run under recycling conditions. A complete evaluation at one reactor temperature can be made with 3 gal. of feed.

The pilot plant is 16 ft. long, 12 ft. high, and 3 ft. wide. It consists of a feed pump, two water pumps for dispersion and stripping steam, a cracking assembly, a product-handling system, and recycle equipment.

The unit operates at atmospheric pressure and at feed rates from 150 to 1,000 ml. per hour. Reactor temperatures have been studied in the range of 895° to 1,025° F. The normal regeneration temperature is approximately 1,075° F., but is adjusted at the beginning of a run to obtain 0.2 to 0.3% by weight carbon on the regenerated catalyst so as to conform with commercial practice.

Dispersion and stripping steam rates are adjusted to approximate those used commercially. The catalyst inventory of 3 lb. of plant equilibrium catalyst, screened to 60-250 mesh, is circulated at rates of 4 to 9 lb. per hour to maintain a catalyst-to-oil ratio of 7:9.

The cracking unit is located in a radiant furnace with the catalyst hopper at the top and the regenerator, reactor, and stripper directly below. The regenerator is 21 in. long and 3 in. in diameter. The reactor is 15 in. long by 1½ in. in diameter and the stripper is 13 in. long by 1½ in. in diameter. Both the regenerator and reactor have expanded sections at the top and are equipped with small cyclones to separate the catalyst from the overhead vapors.

Outside the furnace and at the bottom of these vessels is the catalyst lift unit. This is an aspirator which employs a nitrogen jet to lift the catalyst through a ⅜-in. tubing to the hopper at the top of the unit. The catalyst-circulation rate is regulated by positioning the nitrogen jet in the lift unit. When the circulation stops, a thermocouple on the catalyst lift line operates

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'59 Ford Pickups beat average mileage of other leading makes by 25.2% in Economy Showdown U.S.A.

Here at last is certified proof of the differences in gas mileage between six-cylinder pickups . . . evidence that you can use in your operation.

It was compiled by America's foremost independent automotive research firm after testing 1959 six-cylinder ½-ton pickups of the six leading makes. The trucks were bought from dealers—just as you would. After at least 600 miles break-in, all were brought up to manufacturers' recommended specifications.

The tests paralleled every kind of driving—high speeds and low, open highways and city traffic, even door-to-door delivery. Acceleration rates were carefully timed in each gear to insure accurate results for all makes. And to reduce any human factor, test drivers were continually shifted from truck to truck. In every test, '59 Ford Sixes delivered more miles per gallon than any other make!

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'59 FORD PICKUP SIXES GAVE
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31.1% better mileage than make "I"
25.2% better mileage than make "C"
22.0% better mileage than make "S"
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Taken together, Ford got 25.2% more miles per gallon than the average of all other leading pickups!

What's the secret of Ford's economy? First, of all pickup sixes, only the Ford Six has modern Short Stroke design which reduces engine friction and thus requires less fuel. Second, to this modern engine, Ford has added a new economy carburetor to meter fuel more precisely in both high- and low-speed ranges.

See your Ford Dealer for the complete report of Economy Showdown U.S.A. Visit him today and get the whole story firsthand.

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says:

"We've had less downtime with Ford Trucks than with any other make we've used!"

"We service oil wells all over the state of Michigan, plus the northern parts of Ohio and Indiana and I don't think there's a tougher truck operation. Our Ford Trucks are always on the job and most of the jobs take us a long way off the road—in fact we frequently have to make our own roads.

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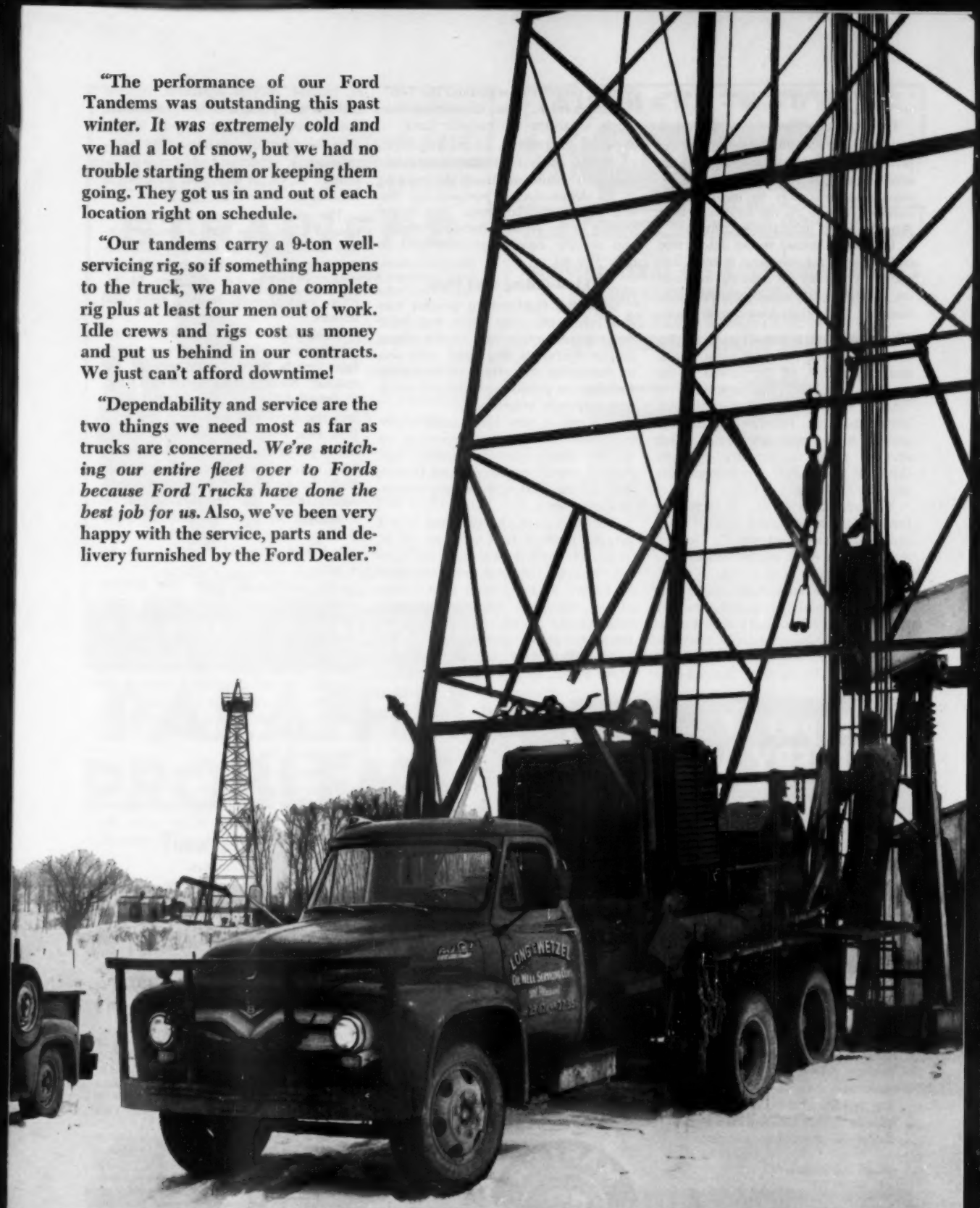
"Our tandems carry a 9-ton well-servicing rig, so if something happens to the truck, we have one complete rig plus at least four men out of work. Idle crews and rigs cost us money and put us behind in our contracts. We just can't afford downtime!

"Dependability and service are the two things we need most as far as trucks are concerned. *We're switching our entire fleet over to Fords because Ford Trucks have done the best job for us.* Also, we've been very happy with the service, parts and delivery furnished by the Ford Dealer."



FORD TRUCKS COST LESS

LESS TO OWN . . . LESS TO RUN . . . LAST LONGER, TOO!

a contact temperature relay to actuate an alarm.

The reactor effluent is dehydrated and debutanized continuously in the product-handling system. Steam in the reactor effluent is condensed and removed automatically by means of an overflow device on the overhead condenser on the dehydrator column.

The liquid holdup in the dehydrator and debutanizer reboilers is only 230 ml. This makes it possible to start up, reach equilibrium conditions, take samples, and shut down in 8 hours.

High-temperature shutoff . . . During the night, while the pilot plant is idle and unattended, all the vessels in the cracking assembly are controlled at 700° F. to speed up the start the following morning. To protect the equipment a high-temperature limit switch on the main temperature recorder shuts off the heat if any temperature exceeds 1,175° F.

To save chart paper, a flexopulse timer starts the recorder every 5 minutes and allows it to run for 20 seconds while it scans all the temperature points and then shuts it off.

The recycle equipment consists of two small fractionating columns and two pumps. The column which separates the heaviest fraction of the cycle oil is made of 1½-in. tubing, 11 in. long, with a 3¾-in.-long flanged-glass cylinder reboiler to withstand the 740° F. temperature. The second column which separates the recycle stock is made of 1-in. tubing, 23 in. long, with a 100-ml. glass flask for a reboiler. Synthetic crude oil from the bottom of the debutanizer is pumped into the first of the two columns. The liquid holdup in the product-handling system and recycle equipment combined is only 550 ml.

Fluid-Coking Pilot Plant

Since the fluid-coking process was new when the pilot plant was built and not too much was known about recycle operation, the initial work was to determine the effect of operating variables on product quality and yields under recycle conditions.

The unit is now being used to obtain yields and product properties on various heavy vacuum residua and flashed heavy crude oils to furnish data for the IBM 650 refinery-simulation program.

The pilot plant charges from 1 to 4 gal. per hour of feed and uses 50 lb. of 40-100-mesh fluid coke in the reactor. Reactor temperatures from 950° to 1,050° F. have been used. Most of the important operating variables used in the commercial unit can be duplicated in the pilot plant.

The pilot plant consists of a feed-drum heater, feed pump, feed preheater, reactor, recycle separator, recycle and quench pumps, steam generators, water knockout system, gas-oil tower, and debutanizing column. The reactor-recycle separator and pump assembly is 11 ft. high and occupies a floor space 2 by 5 ft.

The reactor itself is a 2-ft.-long section of 12-in. pipe with a conical bottom and flanged at the top. The recycle separator located above the reactor is a 3-in.-i.d. column, 34 in. long, packed with raschig rings and helices.

In operation, feed and recycle at approximately 400° F. enter a single feed nozzle near the bottom of the reactor. Steam, superheated to 1,050° F. passing through this nozzle atomizes the feed and spreads it out in a thin film over the 950° F. fluidized coke particles. The cracked vapors and unconverted feed escape along with the steam into the recycle separator. Here the reactor effluent is quenched to 760° F. and the high-boiling, unconverted material is separated and recycled back to the reactor.

The overhead from the recycle tower then is condensed and the water removed by a capacitance-type relay liquid-level control. After reheating, the gas oil, gasoline, and gas are separated in the gas-oil and debutanizing towers. As the coke level rises in the reactor, as a result of coke being produced, it is withdrawn through a lock system connected to the reactor at the top of the bed.

Although this pilot plant has fewer automatic controls than the others, it runs with a minimum of attention. One man can start it up, take the samples, and shut it down by himself.

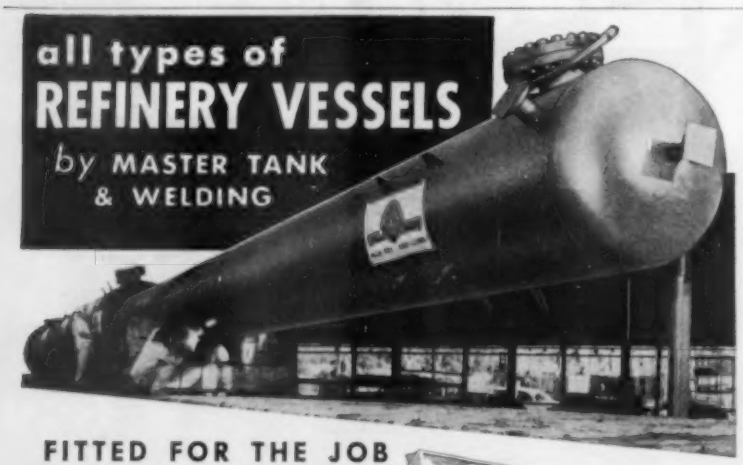
References

1. C. K. Viland, "Better Yields After Nitrogen Removal," Petrol. Refiner 37 (3) 197-200 (1958).
2. C. K. Viland, "Evaluation of Cracking Catalysts," Petrol. Processing 8 (12) 1874-79 (1953).
3. C. K. Viland, "Midget Cracker Helps Big Brother," Petrol. Processing 6 (12) 1370-73 (1951).

BOOK

SCIENTIFIC MANAGEMENT OF MARKETING OPERATIONS. By A. N. Seares. Published by Society for Advancement of Management, 74 Fifth Avenue, New York 11, $1.50. 35 pp.

The modern marketing concept (a change in emphasis for a firm from selling what it makes to making what will sell) requires greatly improved skills of market analysis, creativity and creating demand, and company-wide application of the most profitable use of scientific management. The author charts the most advanced thinking and practice for combining modern marketing with profitable sicentific management throughout the organization.



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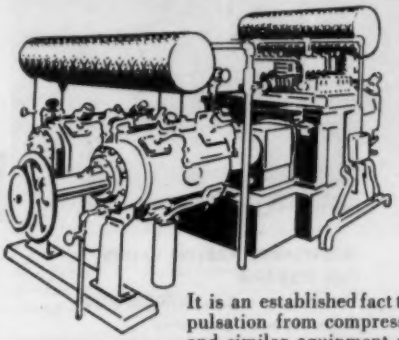
BURGESS-MANNING

SNUBBER NEWS

Dedicated to the Elimination of Pulsation and Intake and Exhaust Noise

HOUSTON TEXAS GAS & OIL CORPORATION'S COMPRESSOR PIPING GUARANTEED TO BE KEPT VIBRATION-FREE BY BURGESS-MANNING SNUBBERS



It is an established fact that pulsation from compressors and similar equipment produces vibration that causes rapid deterioration of equipment, skyrockets maintenance costs and often threatens the very structures housing the equipment.

Recognizing this, the builders of the Houston Texas Gas and Oil Corporation's natural gas pipe line to Florida are installing 48 Burgess-Manning Snubbers of eight different designs on the compressors at the four stations along the line.

Burgess-Manning Company is guaranteeing the successful operation of all compressor piping and related inline equipment without excessive or damaging pulsation.

Successful accomplishment of guaranteed results has become a foregone conclusion to Burgess-Manning customers in the gas transmission, petroleum and chemical industries. If you are experiencing, or anticipating, a similar problem, you can consult Burgess-Manning engineers, without obligation, for a guaranteed successful solution.

This is a cross-section of a Snubber typical of many styles used by Burgess-Manning to eliminate pulsation in gas or air pipe lines, or for the suppression of exhaust or intake noise from internal combustion engines, pumps, etc.

SEND US a brief outline of your pulsation or exhaust noise problems and we will gladly send you pertinent literature.

BURGESS-MANNING COMPANY

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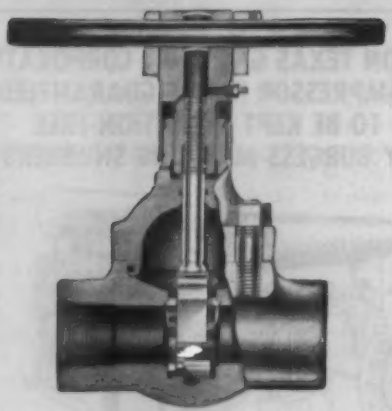
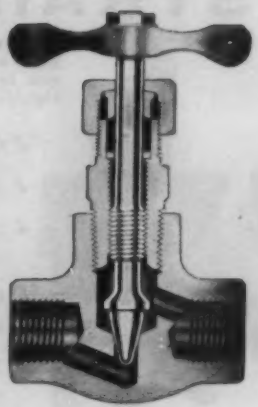
Rockwell-Built Edward Steel

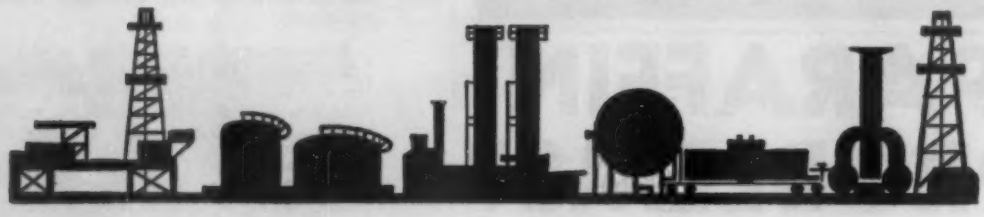


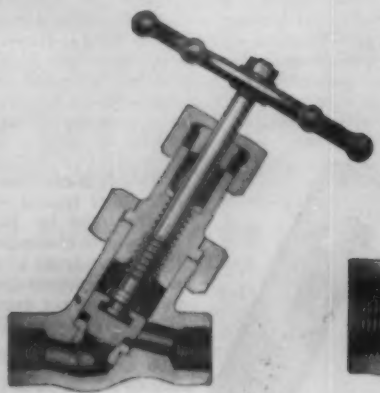
MUDWONDER MUDLINE VALVES
Figs. 2128-3128
For pressures to 2,000-3,000 lb WOG
Bolted bonnets, screwed or flanged ends

GLOBE STOP VALVE
Fig. 158
For pressures to 10,000 lb WOG
Screwed bonnet, screwed or socket welding ends

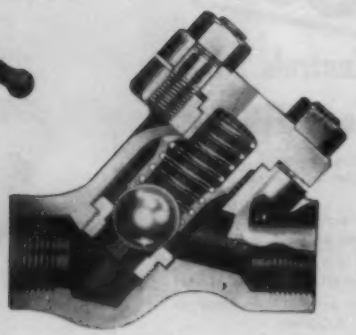


GLOBE GAGE VALVE
Fig. 152
For pressures to 4,000 lb WOG
Screwed or union bonnet, screwed ends

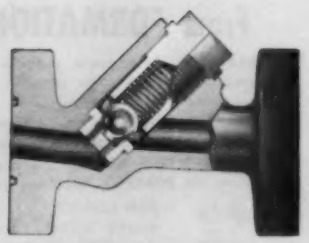




GLOBE STOP VALVE
Fig. 2698
For pressures to 2,000 lb WOG
Union bonnet, screwed or socket welding ends



BALL CHECK VALVE
Fig. 4632
For steam pressures to 600 lb A.S.A. (2,000 lb WOG)
Horizontal or vertical
Bolted cover, screwed or socket welding ends



BALL CHECK VALVES
Figs. 5160-9160
For pressures to 5,000-10,000 lb WOG
Horizontal or vertical, screwed covers, flanged ends

Valves Work Everywhere

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Edward valves are on the job, no matter where you look. From the towering derricks of Northern Alberta to offshore rigs on the Gulf . . . from refineries on the Jersey Flats to California natural gas plants . . . the word is—"You buy a better valve from Edward!"

Edward Globe Valves

Bodies are drop-forged steel, for greater strength and resistance to erosion. Large-diameter handwheels permit operation without a wrench or cheater; cross-arm Impactor* handle for quick, tight closing is standard on 2" Fig. 158. Figures 158 and 2698 have replaceable seats. Disks—both plug and needle types—are carefully aligned, and seats are lapped for tight sealing. Stems are EValloy,* an exclusive Edward stainless steel, centerless ground to a fine finish. Carefully machined Acme stem threads assure easy operation. Bonnet threads plated by an exclusive EValizing* process for maximum resistance to wear and corrosion. Deep stuffing boxes, with exclusive EValpak* asbestos-graphite packing, assure a tight seal with minimum resistance to stem turning.

Edward Ball Check Valves

Identical to Edward globe stop valves in body and seat features. Rolled steel bonnet with integral ribs to guide ball accurately. Ball is corrosion-resistant high carbon stainless steel, precision-ground for tight seating. High carbon stainless steel spring gives positive aid in seating ball.

Edward Mudwonder Valves

Body and bonnet are high-strength alloy steel with heavy body-bonnet cover flanges. Accurately machined to assure drop-tight sealing under extreme pressures. Double-threaded yoke bushing, completely enclosed, gives 2-to-1 ratio. Corrosion-resistant stainless steel stem with slotted gate coupling to eliminate bending or binding. Gate is hard chrome plated to reduce friction, resist erosion and abrasion. Seat insert of resilient buna–N synthetic rubber, molded integrally over steel wear rings. Seat and gate easily replaced without removing Mudwonder* from line.

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Our customers report complete satisfaction in the use of Edward valves for water flood service . . . throttling . . . on high-pressure heaters, treaters and separators . . . on pressure vessel controls . . . on headers and flow lines to heaters and exchangers . . . for manifold service . . . in gasoline or gas sulfur extraction plants . . . for "unloading" valves at gas compressor stations . . . and in many other applications. You name your need . . . let your Edward representative show how to fulfill it with versatile, economical, completely dependable Edward valves. They are available from your favorite oil field supply store, from your industrial distributor, or direct from *Edward Valves, Inc., 1212 W. 145th Street, East Chicago, Indiana* (Subsidiary of Rockwell Manufacturing Company). Represented in Canada by Lytle Engineering Specialties, Ltd., Montreal, and Rotary Sales & Service, Ltd., Edmonton.

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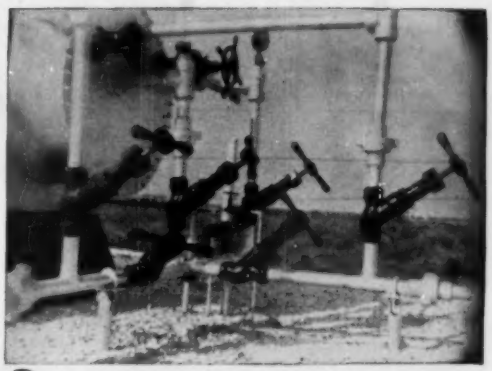
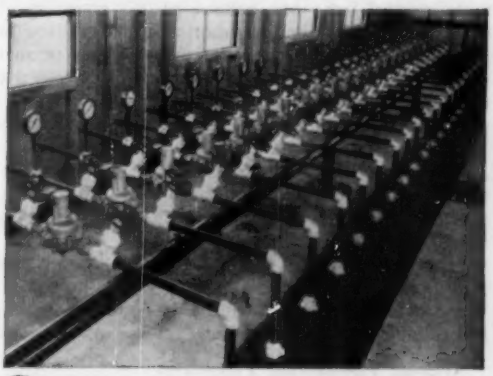


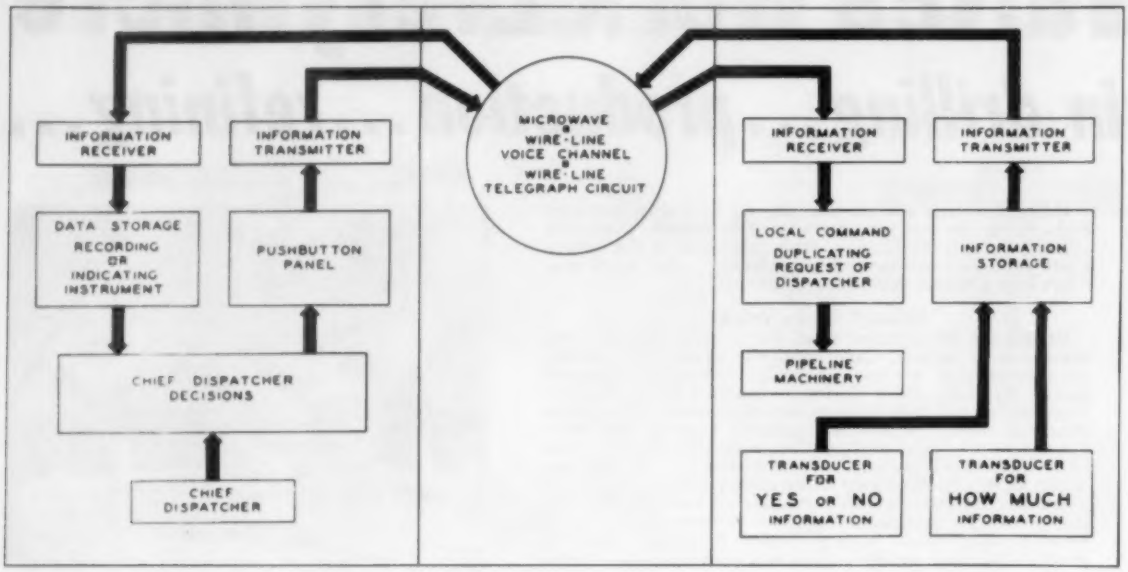
Edward 2" Fig. 158 valves in service on heater by-pass lines in Louisiana oil fields. Note Impactor handles for quick, easy closing against high pressures.

Fig. 2698 valves on cooling coils of natural gas cooler. Scene: New Mexico field processing plant. Lubricated plug valves in photo are Rockwell-Nordstrom.



Forty-two Edward forged steel globe valves (Fig. 2698) throttle the flow on this West Texas water flood. Owner reports absolutely *no* maintenance costs in two years (over 4,000,000 barrels of water)!

FIG. 1



In pipelining, centralized control can best be achieved by . . .

Systems engineering

BY MAX T. NIGH
Engineer Senior Grade, Electrical Section, Service Pipe Line Co.

IN PIPELINING, as in all industry, the compelling forces of competition require that we produce more at less cost and do it more efficiently and accurately than has been possible in the past. In executing the job of moving oil through a pipeline with a maximum of efficiency, accuracy, and safety, it has been necessary to turn to the use of the rapidly expanding field of automation.

Automation up to now has been primarily restricted to the area of remote control from one central point of booster stations and monitoring of pipelines. This has been successful to the extent that one company now is considering the operation of a complete gas-oil-separator plant by remote control.

Thus we enter an area of application in the petroleum industry not heretofore considered for remote control. Automatic handling of accounting and business data to one centralized point is another area being invaded by automation. It will be greatly exploited in the future.

Systems Engineering Philosophy

Automation involves a number of factors, such as instrumentation, communications, business practices, personnel, and a keen appraisal of future expansion possibilities. Application of this automation involves a number of fields heretofore considered areas of engineering specialization not usually crossed by the specialists in each field.

Instrument application engineering of the last 50 years has concerned itself mainly with separate components of the system, rather than maximum efficiency of the total system. Such maximum efficiency can be achieved only through a crossbreeding of engineering. This crossbreeding of engineering into a design philosophy is now termed "systems engineering."

Systems engineering is said by some to include techniques and disciplines which are not found in the curricula, courses, textbooks, and literature of engineering. It has been applied specifically to the engineering of complex data-handling systems involving the factors mentioned above.

As we look to future applications of automation in the petroleum industry, it may be profitable to analyze some of the systems engineering philosophies important to data handling as now applied to centralized monitoring of pipelines and booster stations. In so doing, we hope to show the singular advantages credited to systems engineering as opposed to the more traditional philosophies. By looking at the errors and successes in our applications to date, we will be better prepared to do a better job as we move into automation applications of the future.

Centralized Monitoring Philosophies

We use the term centralized monitoring here to refer to remote control of satellite booster stations and the gathering of pressure, flow, level, and volume information to one central monitoring point.

A block diagram of a centralized monitoring facility is shown in Fig. 1. Considerations for engineering such a system involve:

1. Choice of instrumentation.
2. Choice of communication highway.
3. Data necessary to meet operational needs.
4. Speed necessary for dispatching information to a central point.
5. Choice of form in which the data will be utilized.
6. Security techniques to avoid errors caused by communication or internal circuit interference.

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COMMUNICATION HIGHWAYS available for sending information, ranging in band width from 15 to 5,000,000 c.p.s. Fig. 2.

7. Flexibility of system to handle future expansion.

8. Economic evaluation of various engineering designs.

9. Establishing responsibility for monitoring and proper operation.

10. Margin of operating reliability for components and the system.

Communications Highways

Time does not permit discussion of all these considerations, so I have selected the communication highway to demonstrate how the use of certain aspects of systems engineering differs from just applying components in each specialized area.

The communication highways available for sending all kinds of information is shown in Fig. 2. The four highways shown are (1) telegraph channel or half-duplex channel of 15 c.p.s. band width, (2) voice channel of 3,000-c.p.s. band width, (3) microwave system of approximately 90 voice channels with 1,000,000-c.p.s. band width, and (4) TV channel of 5,000,000-c.p.s. band width.

The band width of these communication highways represents the quantity of information or rate at which information can be transmitted over it. With the exception of telegraph and TV channels, we think of communication facilities as primarily for voice communication.

Since the cost of communication facilities goes up proportionally to the width of the communication channel required, there is considerable economic justification for using the minimum-cost communication facility and engineering the data-handling system on this basis. Whether these facilities are privately owned or leased, the same basic economics applies.

I am reminded of a story that appeared in a petroleum magazine in November 1956 where a pipeline engineer was quoted as saying, "One of the big drawbacks to all our automation is the size of the communication system required. We couldn't afford the wires. Even if we could afford the instrumentation, we couldn't afford the wires or the radio system necessary to operate them. If we did spend that kind of money we wouldn't be a pipeline company with a communication tool, we would be AT&T with plumbing."

Happily, this statement no longer reflects the situation. With presently available systems it is possible to use a minimum amount of communication space and accomplish considerable automation. To bring into focus one phase of the systems-engineering approach, let us compare a few of the existing installations.

Analog or Digital

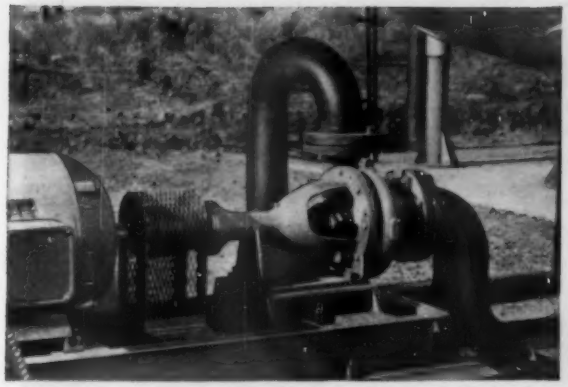
Recently, a gas pipeline installed a remote-control and telemetering system and found it feasible to transmit all the telemetering information in analog form by using one telegraph or tone channel for each variable. At the centralized monitoring point, the analog signals were converted into digital signals for logging on an electric typewriter, and also made available as a five-bit teletype code output. Full extension of this design was to centralize 250 variables from 50 locations.

Another system installed on another gas pipeline, different in design, but intended to accomplish essentially the same results, is an all-digital system where all data are converted to digital form in the field and is then telemetered into the central monitoring point in this form. Since it is already in digital form when received, it is very easily converted or translated to a logging system and suitable for translating into five-bit teletype output for retransmission or storage.

Comparative Costs

Now let's compare costs and communications space required for these two different engineering philosophies. Exclusive of the communications channel, the total cost of equipment per variable between the analog and digital design can be equal or possibly 10% more for the digital. This assumes the same quality of instrumentation and the same presentation of data.

To evaluate the communication channel-width requirements, we assume 50 telemetered values from approximately 10 locations, and a 500-mile pipeline. The analog design



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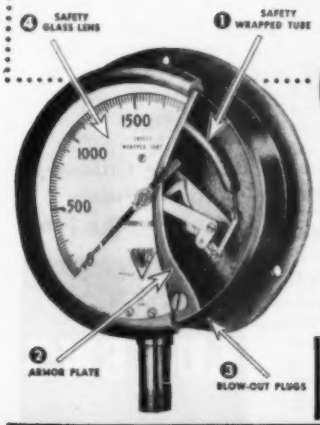

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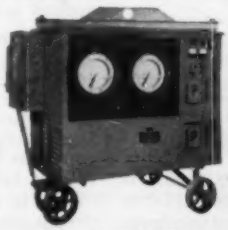

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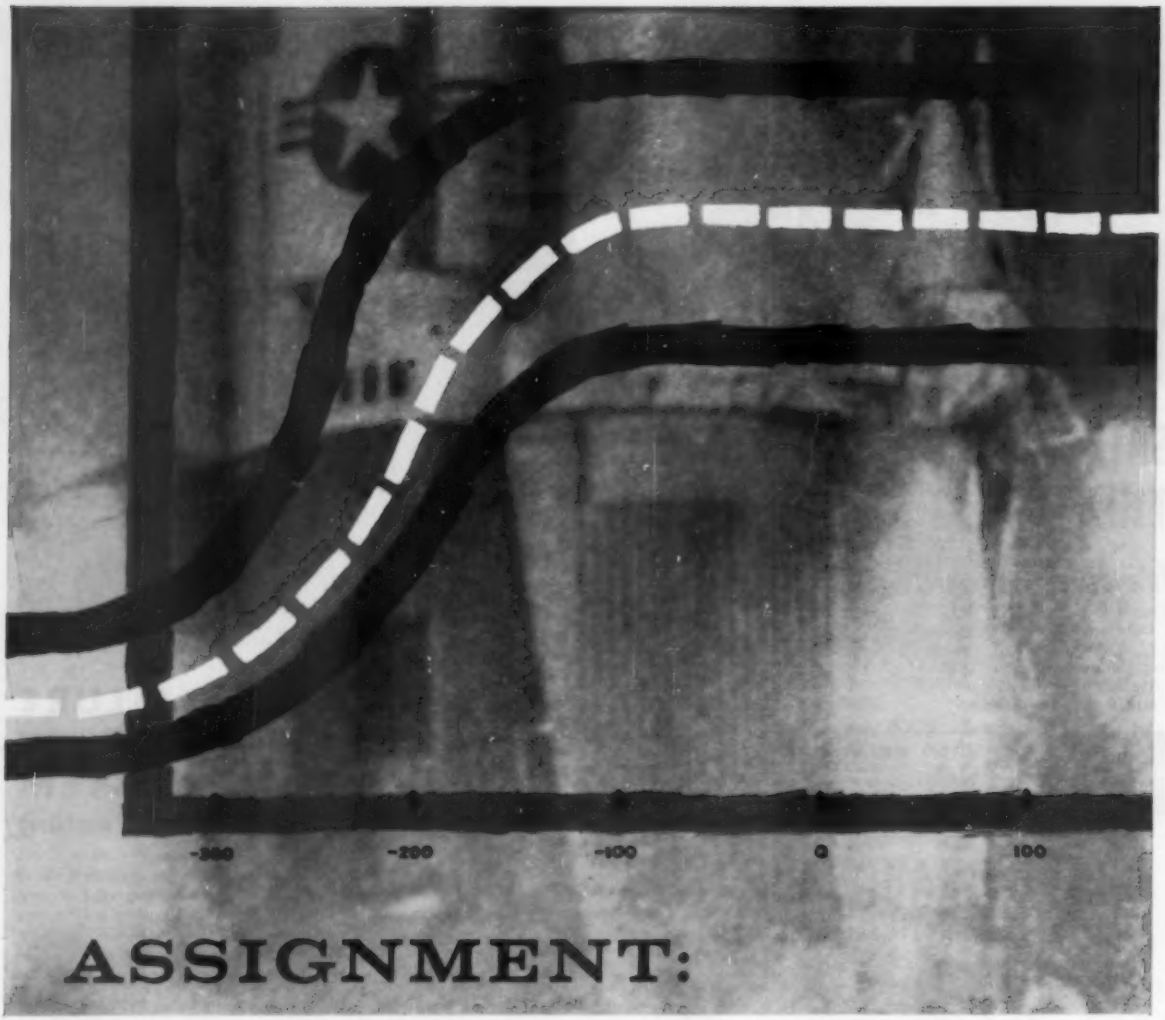

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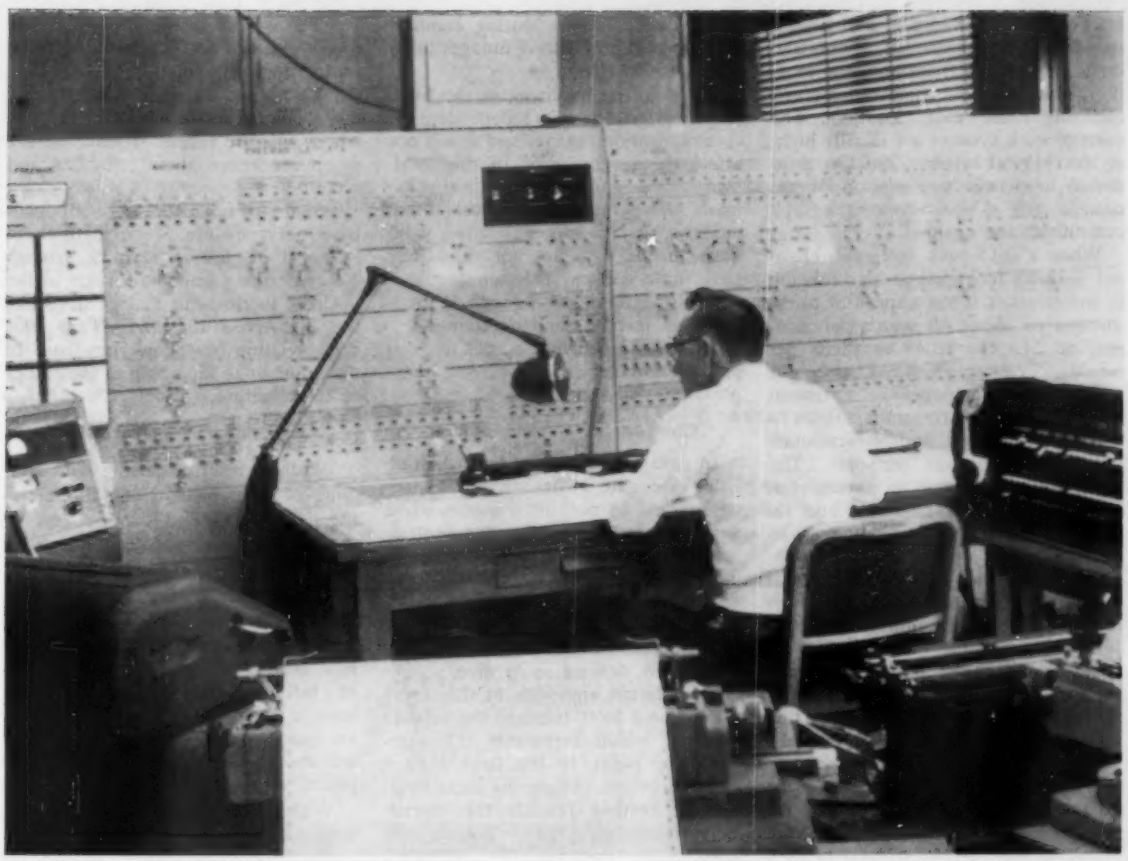

CENTRALIZED MONITORING SYSTEM at Service Pipe Line Co., near Kansas City monitors 10 pipeline stations on three separate pipeline arteries, and logs 31 three-digit variables in 100 seconds on each pipeline. Fig. 3.

would require four voice channels to carry this information, assuming 170-c.p.s. spacing between tone channels.

For equivalent speed of transmission, the digital design requires only one voice channel. If we use AT&T lease-circuit tariffs for determining costs of communications, the savings for the digital systems would be roughly $31,000 per year. Using the payout method, this saving in operating expense represents a payout of 1 year or less for the digital over the analog system. It could be done on a full-duplex telegraph channel, resulting in further saving, with some reduction in speed of transmission.

Design Philosophies

Comparing design philosophies, we find in the analog system that each separate component is doing the job. The result is a workable system. When the various parts are merged into the system, however, the results do not reflect the most efficient system—even though the components are economical.

In planning a digital system, engineers cross the barriers of their specialities and use a crossbreeding of engineering where the proper combinations of the component parts will represent the most efficient and economical system. Again I say, it is the crossbreeding that constitutes the philosophy of systems engineering.

We have assumed in this comparison that all the data are available at the centralized monitoring point with equivalent speeds of transmission.

The Digital System

In the analog system, which in this case was assumed to be time impulse, the speed of transmission was eight digits per minute. This assumed 1% accuracy and thus two significant digits per variable and a 12-second time cycle.

In commercial digital telemetering equipment, the speed of transmission is about 60 digits per minute for one typical system. This includes an identification code for each three-digit number or variable. Since the information from any one location will be from three to five variables, we have a speed of transmission of 9-15 seconds for all information from any one location. This is roughly equivalent to the analog speed for any one or all the variables from one location.

Thus, one tone channel from each location allows us the same speed of transmission. In order to keep the data from separate locations valid, it is necessary to appreciate that the oil or gas in a pipeline travels at approximately 6 ft. per second and that pressure waves travel at the speed of sound in the medium.

With stations spaced 50 miles apart, any hydraulic change at one location would not be observed at upstream or downstream stations until 80 seconds had elapsed in the case of oil and nearly twice this time in the case of gas. If we transmit digital data only when it changes at any one location, we have time to keep the central point as up to date as with the analog system.

To further increase the speed of transmission in the digital system, we can place two receivers at the office and alternate between the two receivers for reception of information. Properly sized office units would represent no increase in equipment cost.

It is well to point out that there are available electronic time-impulse or pulse-width modulation systems which

are considered semidigital and have a speed of transmission of about 250 digits per minute from any one location. These require separate telegraph channels from each location. The costs of such systems are usually higher than digital systems, but are mentioned to permit appreciation of the capacity of a 0-15-cycle telegraph communication channel.

When a 0-15-c.p.s. telegraph channel is used for teletype transmission of information, it has a speed of transmission of about 40 words per minute, or 240 characters or digits per minute (5 characters plus 1 space per word). This approaches the maximum possible rate of transmission on a 0-15-c.p.s. channel, and is mentioned only for comparison purposes. The slowest-speed teletype in commercial use is 60 words per minute and requires a slightly wider channel (0-23 c.p.s.).

The principal reason the typical digital system mentioned previously is only 60 digits per minute, or one-fourth the possible speed, is that security techniques such as redundancy, totalizing, parity check, etc., are used to guarantee that interference on the communication channel will not permit reception of false information.

There are no security checks on the teletype transmission or on either the semidigital or analog systems. So once again, as we review our system as a totality, we must recognize that an increase in security requires a reduction in possible speed.

Service Pipe Line's Digital System

Fig. 3 shows a centralized monitoring system at Service Pipe Line Co. near Kansas City. This digital system monitors 10 pipeline stations on three separate pipeline arteries and logs 31 three-digit variables in 100 seconds on each pipeline. It uses a separate tone from each location and two receivers. Its relatively slow speed compared to teletype is due to maximum security against false registry of data transmission.

Another problem attendant to centralized monitoring of a pipeline that can profit from the systems engineering approach is where to store information. Information I wish to consider here are (1) totalizing of flow or pressure values, and positive-displacement-meter readings, and (2) controls requiring switching of gates based upon a particular volume of fluid passing a certain point.

Should we totalize variables at the centralized monitoring point as obtained on telemeter receivers, or in the field and transmit the totalized variable as a separate reading? If we do our totalizing at the central point, how will we totalize during communication outage? During outages these values are lost forever.

If we do the totalizing in the field, the totalized value is independent of communication outages and it will not affect the accumulation of this totalized value. Sending the totalized value in as a separate reading costs more money, but it does guarantee valid data. If the data are not valid they have little value. Telemetering systems using both techniques for totalizing are installed and operating.

As for the problem of positive-displacement-meter readings, the same philosophy applies as above.

Controls for Gate Switching

In case of the control for switching gates, the gate switching can be accomplished by pushing a button when a telemetered receiver at the centralized point reaches a particular value. This operation is very vulnerable to communication outage since the operation has to be performed at a particular moment, a moment which is not clearly defined as to time.

A different approach to this operation would be to transmit the volume reading, which represents the gate-switching point, to the field 1 to 3 hours previous. When the local field-volume reading reaches this stored-control reading, the switching will take place automatically. Granted, this represents increased cost of instrumentation, but it reduces the level of reliability required of the communication system. It is well to keep in mind that an increase in reliability of communication represents an increase in the cost of equipment and operation.

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When we drive around town at low speed within a few blocks of a filling station and garage, the reliability of our car is not of much concern, but on a high-speed congested turnpike where aids are farther distant, we are much concerned about reliability and security.

When we plan on a component basis only, we are prone to think in terms of the low-speed town driving. Yet, we must admit the totality of the business world is in reality more like the high-speed turnpike. Thus, this crossbreeding of engineering tends to discipline us in facing up to the reality of the situation.

Integrated Data Processing

We have been discussing data handling of only pipeline-operational information. There is another area of data handling which has not been widely used in the pipeline or petroleum industry in general. This kind of data handling has been referred to by some as "Integrated Data Processing" or IDP. It involves transmission of business-accounting information, such as payrolls, sales, purchases, inventories, etc., and prepares it for processing through a central computer.

With this method it is possible to transmit and process in minutes such information from plants, branch offices, or business units in a geographically decentralized business operation.

Integrated data processing is a digital system and is set up to use a 5-bit teletype code. The two principal problems for the user, from an engineering standpoint, are, (1) reduction of the field data to digital or coded form for transmission, and (2) securing this data against registry of false information at the central point that results from communication interference or transmission errors.

Instrumentation techniques are available for conversion of data to digital or coded form. To the second problem, securing valid data, two of the many possible methods that can be applied are (1) standardization on a seven or eight-bit teletype code with parity check as a security technique as opposed to the five-bit teletype code now commonly used, or (2) paralleled transmission of five-bit data and comparison of reception at the central point before acceptance.

Many industries have successfully handled their accounting data through computers. Since the petroleum industry generally has been successful in handling accounting data through a central computer, it is logical that it could next move to transmitting the accounting data to a central point.

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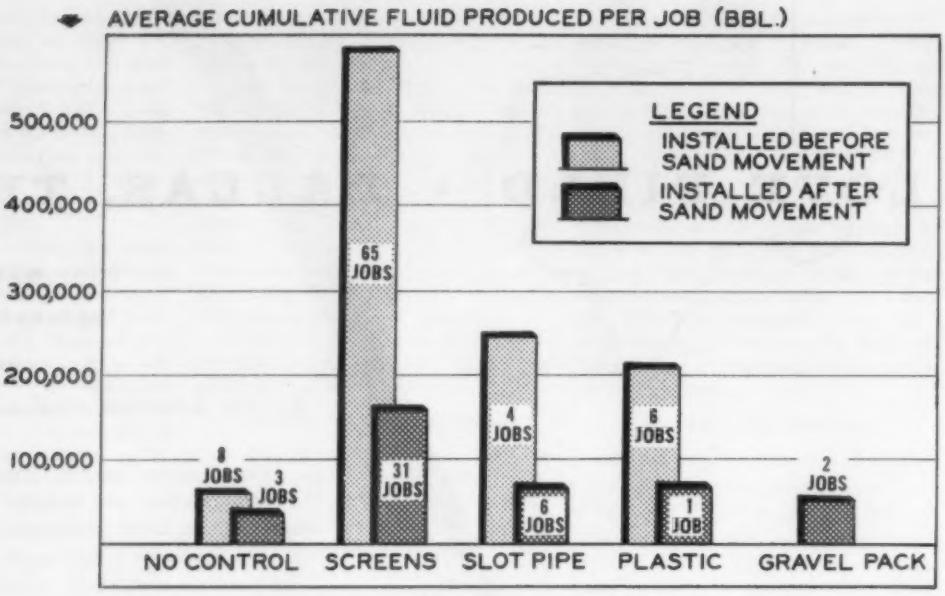

IMPORTANCE of taking remedial action before sand movement has taken place is shown by these results. Fig. 1.

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30 years of sand-control experience

An analysis of 118 sand-control jobs in 32 wells producing from 55 zones over a period of 30 years yields valuable information on sand-control techniques.

THIS ARTICLE covers experience in the shallow producing sands at Black Bayou field on the Gulf Coast of Louisiana near the Texas border. Age of the producing formations is Miocene and upper Oligocene. This area was selected because of: (1) the large number of wells and sand-control jobs involved; (2) the predominantly water-drive production with accompanying large fluid volumes; (3) the long productive history, nearly 30 years; and (4) the fact that most wells involved have been abandoned, thus giving a complete productive history.

This study covers 32 wells which have produced from 55 separate zones on which there have been 118 sand-

Presented at the spring meeting, Southern District, API Division of Production, New Orleans, March 25-27, under the original title, "Thirty Years of Sand-Control Experience, Black Bayou Field, Cameron Parish, Louisiana."

From this study, the author concludes:

1. For lasting success, sand-control measures should be installed before there is any movement of formation sand. No popular technique has been satisfactory after sand movement occurs.
2. Wire-wrapped screens have proved far more successful than any other technique in open-hole completions and in perforated 7-in. or larger casing.
3. Sand-consolidation plastic has shown greater success than screens in 5½-in. or smaller casing, but experience is limited.
4. Sand can be controlled much more effectively in open-hole completions than in perforated casing.
5. Screen gages sized to retain 10% of formation sand have been most successful.
6. Screens as small as 0.008 gage can be used successfully when required in open hole. There has been no applicable experience with screens smaller than 0.010 gage in perforated casing.
7. Shaliness of the sand and length of producing interval have no significant effect on sand-control success.

Similar comparisons in other areas would be desirable, and the jobs studied included no sand packs and only two remedial gravel packs.

By P. E. DESJARDINS
Shell Oil Co., Lafayette, La.

TABLE 1—RESUME OF OVER-ALL EXPERIENCE

Type sand control—	Total jobs	Jobs which produced negligible* cumulative fluid		Jobs which failed but after significant cumulative fluid		Jobs successful to depletion or to present		Average fluid produced per job (bbl.)
		No.	Per cent	No.	Per cent	No.	Per cent	
Screen	96	36	37	40	42	20	21	446,000
Slot pipe	10	5	50	4	40	1	10	137,000
Plastic	7	2	29	5	71	0	0	188,000
Prepacked gravel screen	3	3	100	0	0	0	0	0
Gravel pack	2	0	0	2	100	0	0	52,000
No control	11	5	46	4	36	2	18	52,000
Total or average	129	51	40	55	42	23	18	358,000

*10,000 bbl. or less.

TABLE 2—CONTROL JOBS PERFORMED BEFORE ANY SIGNIFICANT SAND MOVEMENT*

Type sand control—	Total jobs	Jobs which produced negligible† cumulative fluid		Jobs which failed but after significant cumulative fluid		Jobs successful to depletion or to present		Average fluid produced per job (bbl.)
		No.	Per cent	No.	Per cent	No.	Per cent	
Screen	65	18	28	28	43	19	29	583,000
Slot pipe	4	2	50	2	50	0	0	244,000
Plastic	6	2	33	4	67	0	0	208,000
No control	8	3	37	3	38	2	25	59,000
Total or average	83	25	30	37	45	21	25	‡489,000

*Includes: (1) initial jobs; (2) repair jobs where there was no previous significant fluid production; and (3) repair jobs where significant fluid had been produced but where failure of previous control jobs was caused by plugging rather than sanding up. †10,000 bbl. or less. ‡Average water cut: 69%. Average fluid after first water: 420,000 bbl.

TABLE 3—CONTROL JOBS PERFORMED AFTER PREVIOUS SAND PRODUCTION*

Type sand control—	Total jobs	Jobs which produced negligible† cumulative fluid		Jobs which failed but after significant cumulative fluid		Jobs successful to depletion or to present		Average fluid produced per job (bbl.)
		No.	Per cent	No.	Per cent	No.	Per cent	
Screen	31	18	58	12	39	1	3	158,000
Slot pipe	6	3	50	2	33	1	17	65,000
Plastic	1	0	0	1	100	0	0	67,000
Prepacked gravel screen	3	3	100	0	0	0	0	0
Gravel pack	2	0	0	2	100	0	0	51,000
No control	3	2	67	1	33	0	0	34,000
Total or average	46	26	57	18	39	2	4	‡122,000

*Includes all repair jobs following significant fluid production and previous sandup. †10,000 bbl. or less. ‡Average water cut: 87%. Average fluid after first water: 117,000 bbl.

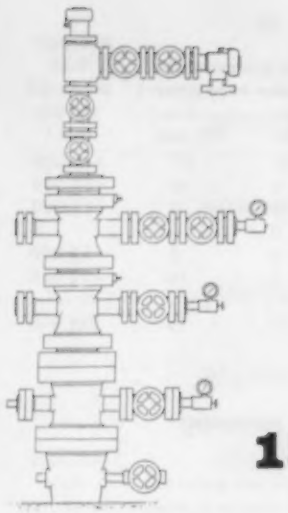
control jobs and 11 attempts to produce without sand control.

Most techniques have produced, on the average, sufficient oil (30% of total fluid produced has been oil) to pay out individual control jobs and show in some cases an attractive profit. However, the magnitude of the sand-control problem is evident from the fact that more than five out of six sand-control jobs failed before depletion of the well and that two out of every five jobs were complete failures. In many cases, wells were abandoned when control jobs failed and production could not be restored.

Timing . . . The most significant single factor influencing success of the sand-control measures studied was timing. The data show very clearly that, after the formation has been disturbed by sand production, it is seldom possible to control sand effectively. This places extreme importance on the success of the initial sand-control measure in any completion.

To analyze the effect of previous sand movement on success in sand control, the jobs considered have been broken into two groups: (1) control jobs performed before any significant sand production in the well; and (2) control jobs performed after sand production commenced. Tables 2 and 3 show that sand-control measures installed before any formation-sand movement occurred yielded, on the average, four times as much fluid as those installed later. Although in both categories there are a discouraging number of failures, the incidence of complete failures was nearly twice as great when there had been previous sand movement.

Fig. 1 shows the experience with various control measures and the comparison of measures installed before and after sand movement. It is evident



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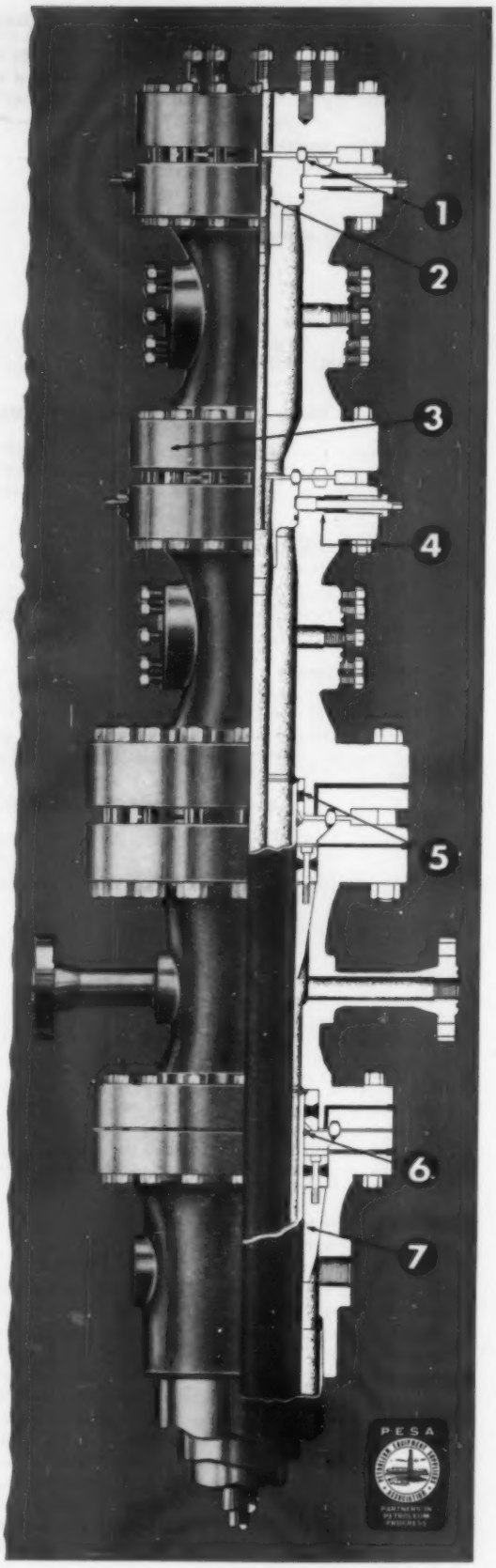

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TABLE 4—BREAKDOWN OF JOBS COVERED IN TABLE 2

	Total jobs	Jobs which produced negligible* cumulative fluid		Jobs which failed but after significant cumulative fluid		Jobs successful to depletion or to present		Average fluid produced per job (bbl.)
		No.	Per cent	No.	Per cent	No.	Per cent	
Initial control jobs	53	13	25	24	45	16	30	690,000
Remedial jobs (no previous sand movement)	9	2	22	4	45	3	33	299,000
Remedial jobs (previous sand up but negligible fluid produced on all previously sanded-up jobs)	13	7	54	6	46	0	0	65,000
Total or average	75	22	29	34	46	19	25	535,000

*10,000 bbl. or less.

from this figure that, regardless of the type of control used, the measures installed before sand movement always yielded about four times as much fluid as those installed after sand movement. It is also evident that in this field, attempts to produce without any sand control have not been successful.

To investigate further what influence a very minor amount of sand movement had on ultimate fluid produced through any sand-control measure, the jobs before any sand movement in Table 2 were broken down. All jobs with no control were eliminated, and the remainder were divided into three groups: (1) initial jobs; (2) remedial jobs where the previous job had failed because of plugging or, in one case, had not failed; and (3) remedial jobs following a previous sandup, but where there had been negligible fluid produced through the previous control job which sanded up. Table 4 shows the experience with these three groups.

Table 4 shows rather clearly that the success of a sand-control measure is to a great extent dependent on installing the sand control before there has been any movement whatsoever of formation sand.

Comparison of Sand-Control Material

Tables 1, 2, and 3, and Fig. 1 show that the conventional wire-wrapped screen has permitted, on the average, far greater trouble-free fluid production than any other sand-control material used. There are, however, two blind spots in the experience on the shallow Black Bayou wells:

1. In no case has sand packing been used.

2. In no case has gravel packing been used initially.

Thus, this analysis does not necessarily detract from sand and gravel packs. On the contrary, these control measures, when effectively installed, should in theory prevent initial movement of formation sand. The shallow Black Bayou experience shows that this is of utmost importance.

The analysis does show that the conventional wire-wrapped screen, one of the oldest sand-control measures in current use, has greatly outperformed slot pipe, sand-consolidation plastic, and no control. In the particular case of completions in perforated 5½-in. or smaller casing, sand-consolidation plastic has shown prospect of greater success than conventional screening.

It is also important that, in all jobs where maximum fluid-production rates exceeded 1,300 bbl. per day (there were 13 such jobs), the sand-control method was screening, and in 10 of these there had been no previous sand movement. The highest fluid rate through any of the jobs studied was 6,800 bbl. per day through a 0.012-gage wire-wrapped screen which had been set in open hole when the well was completed. This well had a sustained fluid rate of 6,000 bbl. per day for 1½ years and produced nearly 5,000,000 bbl. of fluid before depletion. There was no screen failure.

Screening

Initial screens set in open hole were far more successful than those set in perforated casing.

Many of the original completions were made in open hole with casing cemented on top of the sand. Table 5 shows a comparison between wells screened in open hole and wells screened in perforated casing.

In the initial screening, superior performance is seen in the open-hole completion. Nearly half were permanently successful, and the average fluid production was more than four times as great as with screens set initially in perforated casing. The incidence of complete failure was also much lower.

With screens set after sand movement, experience was poor in both open-hole and perforated-casing completions. Sixty-eight per cent of all screens set in perforated casing after previous sand movement failed to yield any significant fluid. The difference in the average fluid produced is not considered great enough to be significant in this statistical analysis.

Although open-hole well completions are seldom used in South Louisiana today, the experience at Black Bayou suggests that consideration should be given to this type of completion in areas of known sand-control problems.

Significance of Casing Size

In perforated-casing completions, screens are somewhat more successful in larger casing. In small perforated casing, limited data suggests that sand-consolidation plastic may have application.

Table 6 presents comparative experience with screening in large and small perforated casing. Only jobs before significant sand movement and on zones which ultimately yielded significant fluid are considered.

Although the divergence in fluid produced in the two cases considered in Table 6 is not sufficiently great to permit a firm conclusion, it does show that there is a somewhat better chance to successfully screen the initial completion in larger perforated casing. In any event, no other method used was more successful than screening in large perforated casing.

To compare an alternate technique, a similar table (Table 7) has been prepared for sand-consolidation plastic. This indicates that experience has been favorable with sand-consolidation plastic in perforated small casing, but this experience is based on a very limited number of jobs and must be considered cautiously. The high fluid recovery with plastic in small casing has been unduly influenced by one highly successful job which yielded 998,000 bbl. of fluid over a 10-year period.

This job shows that plastic may

TABLE 5—COMPARISON OF SCREENS IN OPEN HOLE AND IN PERFORATED CASING

	Initial screen				Screen set after sand movement			
	Open hole		Perforated casing		Open hole		Perforated casing	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
Number of jobs	27	...	19	...	16	...	25	...
Number successful to depletion or present	12	44	4	21	0	0	1	4
Number which produced negligible fluid	5	19	6	32	6	37	17	68
Number failed due to plugging	4	15	6	32	2	12	4	16
Number failed due to cutout	11	41	9	47	14	88	20	80
Average fluid produced, bbl.	1,090,000		260,000		101,000		166,000	

TABLE 6—COMPARISON OF SCREENS IN LARGE AND SMALL PERFORATED CASING

	No. jobs	Average fluid produced (bbl.)	No. of jobs which yielded negligible fluid
Screens in 7-in. casing	14	330,000	3
Screens in 5½ and 5-in. casing	10	204,000	2

TABLE 7—COMPARISON OF CONSOLIDATION PLASTIC IN LARGE AND SMALL PERFORATED CASING

	No. jobs	Average fluid produced (bbl.)	No. of jobs which yielded negligible fluid
Plastic in 7-in. casing	3	22,000	2
Plastic in 5½ and 5-in. casing	3	395,000	0

have application in the special case of perforated small casing; but the other two jobs, which produced 117,000 and 69,100 bbl. of fluid, indicate that some refinement in installation technique would be required before this technique could be generally accepted.

Effect of Salt-Water Production

Sand-control failures were analyzed to determine what influence first-water production may have had on the failure. As shown on Fig. 2, more than half of the failures of control jobs in perforated casing occurred within 9 months after the appearance of first water. In most cases the fluid rates at the time of failure were the highest in the wells' history.

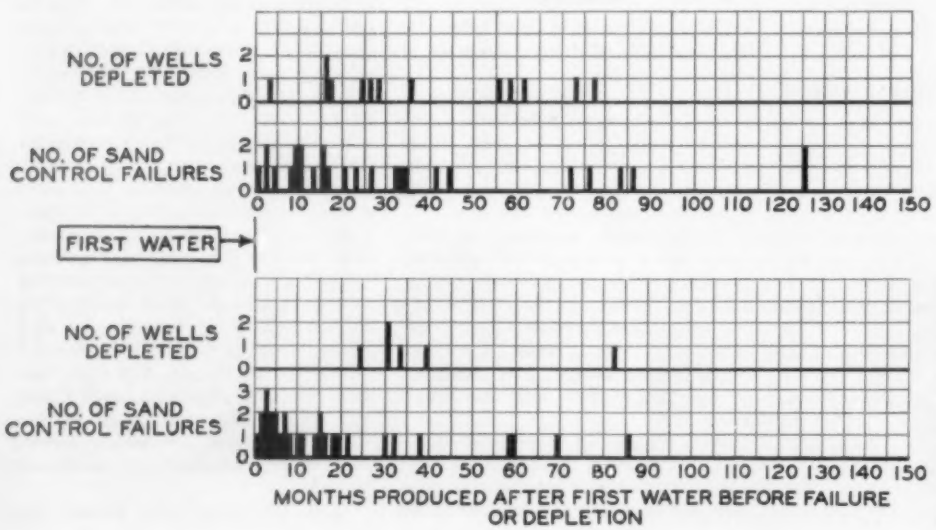
Sand control in open-hole completions was not noticeably affected by the appearance of first water. Only 15% of the failures occurred within 9 months after first water. Inspection of the time distribution of failures on Fig. 2 shows a fairly even distribution of the failures, indicating that first water production is not a significant factor in these failures.

Selection of Screen Gage

The commonly accepted basis for selecting a screen gage in the Gulf Coast is that the screen used should retain 10% of the sand. Adherence to this rule has given the greatest success.

In the wells studied there were 21 completions on which screen analyses of the formation sand were available and in which wire-wrapped screens were the initial sand-control measure. The method of obtaining a sand sample for screen analysis was not uniform. Samples were taken from random cores, produced sand, bailed sand, and drill-stem tests. In addition, cores of many of the producing intervals showed wide divergence of grain size, so that no one screen gage would be expected to be correct for all portions of the producing interval. In spite of this, the experience with the initial screen in these 21 completions, as presented in Table 8, shows a conspicuous trend.

From the foregoing comparison, it appears that experience bears out the success of the 10% rule. Because data were available on only four wells with screens sized to hold 10% of the formation sand, and all of these were completed in open-hole where better results are expected, the benefit from this screen sizing alone may not be as great as Table 8 indicates. In the last two columns of Table 8, a greater number of completions were available for comparison and both open-hole


NO. OF WELLS DEPLETED
NO. OF SAND CONTROL FAILURES
FIRST WATER
NO. OF WELLS DEPLETED
NO. OF SAND CONTROL FAILURES
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
MONTHS PRODUCED AFTER FIRST WATER BEFORE FAILURE OR DEPLETION

APPEARANCE of first water in open-hole completions, top, is not a significant factor in completion failures. In perforated-casing completions, below, more than 15% of the failures occurred within 9 months of the appearance of first water. Fig. 2.

TABLE 8—EFFECT OF ADHERENCE TO 10% RULE IN SELECTION OF SCREEN GAGE

	Screens to hold 10%	Screens to hold less than 10%	Screens to hold more than 10%
Total number of screens	4	9	8
Range of screen sizes	0.010 to 0.014	0.010 to 0.014	0.009 to 0.012
Number which produced negligible fluid	1 (25%)	3 (33%)	2 (25%)
Number successful to depletion or present	1 (25%)	3 (33%)	2 (25%)
Number which failed due to plugging	0 (0%)	1 (11%)	4 (50%)
Number which failed due to cutout	3 (75%)	5 (56%)	2 (25%)
Average fluid produced through screen	2,028,000	204,000	529,000
Average fluid produced through screens which cut out	1,115,000	107,000	483,000
Maximum fluid rate achieved, bbl. per day	6,800	950	2,100

TABLE 9—COMPARISON OF PERFORMANCE OF VARIOUS SCREEN GAGES

Initial screen gage	No. of installations	Installations which produced negligible fluid		Installations successful to depletion or present		Plugged		Cutout		Average fluid produced (bbl.)
		No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	
0.008	4	1	25	0	0	0	0	4	100	365,000
0.009	1	0	0	1	100	0	0	0	0	1,656,000
0.010	31	8	26	10	32	10	32	11	36	597,000
0.012	3	0	0	3	100	0	0	0	0	3,302,000
0.014	6	2	33	2	33	0	0	4	67	466,000

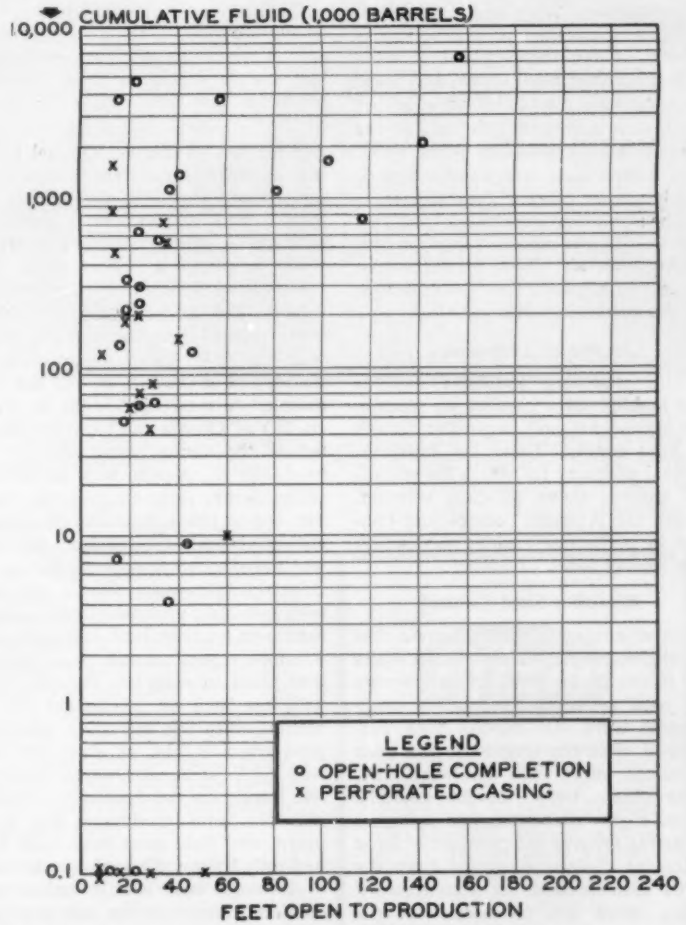
and perforated-casing completions were represented. From these two columns it appears that, if no sand sample is available for screen analysis or there is any question as to the proper screen gage, a smaller-gage screen to hold 10% or slightly more of the sand would, at some risk of plugging, prove more successful.

As many producing sands in the Gulf Coast are quite fine, proper screen sizing would often require use of a screen smaller than 0.010 gage, an uncommon practice at present. Only a few of the wells studied have had screens smaller than 0.010 gage installed initially. Experience with these as compared to the larger-gage screens is shown in Table 9.

The lack of trend or relationship in Table 9 suggests that screens finer than 0.010 gage are no more subject to plugging than larger gages and can be successfully used, particularly when screen analysis shows they are warranted. However, it should be noted that in Table 9 all experience with 0.008 and 0.009-gage screens has been in open-hole completions. The high incidence of plugging in the 0.010-gage screen is probably because this gage was used generally when no sieve analysis was available, and therefore a great many of this gage were probably missized.

Sreening in Shaly and Clean Sands

This analysis was limited by the few wells on which fairly complete core data showed the sand to be uniformly shaly or clean through the producing interval. The data from these



OPEN-HOLE COMPLETIONS show a tendency toward longer producing life than do perforated-casing completions. Fig. 3.

TABLE 10

	No. jobs	Number which produced negligible fluid	Average fluid produced (bbl.)
Shaly sands	9	2	709,000
Clean sands	10	2	919,000

wells are in Table 10. Only experience with the initial sand-control job is considered.

In this type of statistical analysis a small divergence in experience as shown in Table 10 is not considered significant. It appears from the experience, therefore, that sand can be controlled as successfully in shaly as in clean sands.

Length of Interval

Analysis of initial screens in the completions studied shows that there is no useful relationship between the amount of fluid produced and the length of interval open to production.

In the wells studied, the producing intervals ranged from 10 to 157 ft. Fig. 3 shows the relationship between fluid produced through an initial screen vs. the length of interval open to production. With less than 60 ft. open, no relationship whatsoever is evident. There were only five wells with more than 60 ft. open, and these all produced substantial amounts of fluid. It is noteworthy that all of the long-producing intervals were open-hole completions, which offer significantly greater prospects for success.

The significant conclusion from Fig. 3 is that in the normal range of producing intervals (10 to 60 ft.) screen success is not affected by the length of the producing interval.

Improved Techniques

The preceding statistical analysis has highlighted a number of successful approaches and important factors in sand control. There are, however, several problems for which the statistical analysis shows no clear solution. These are remedial control and control in perforated casing, particularly the smaller sizes of casing.

Remedial Sand Control

Experience at Black Bayou has highlighted quite successful techniques for initial sand control, but has shown no good approach to remedial sand-control work. Of control jobs performed after the formation had been disturbed, more than half were complete failures. Only a few jobs could be called highly successful, and instances of casing failures and recovery of large pieces of shale and cement from the wells indicate that, in a number of cases, there was subsidence of the shale overlying the producing sand.

It appears that any successful remedial technique must not only screen the sand in the well bore but must reconstruct a tightly packed permeable network behind the casing, so that conditions approaching the original undisturbed sand are restored. Sand and gravel packs are designed for this type of control. However, both remedial gravel packs covered by this study failed after small production, one because of sandup and the other because of plugging. This suggests that on these jobs packing was probably not sufficiently tight, thus permitting movement of formation material which caused failure.

One experimental job has been performed in which the normal packing technique was modified to assure a tight pack by displacing sand in gelled lease crude at high rates and pressures as in fracturing. This job was performed on a well in the Iowa field, which produced from a 10-ft. reservoir in which the sand was extremely fine and in which all three previous producers had been junked because of sand-control difficulties. Screens and normal low-pressure gravel packing had failed to control this sand effectively. The well was sanded up with a hole in the screen, and had produced a large quantity of sand.

In an attempt to restore initial formation-sand conditions for effective sand control, the well was sand-packed using gelled oil as the carrying fluid with up to 4 lb. per gal. of sand pumped in at the rate of 4½ bbl. per minute. A total of 95,000 lb. (950 cu. ft.) of Ottawa sand was displaced behind the casing, using pressure up to 5,000 lb., which was considered adequate not only to pack the sand but also to create fractures. No clean-cut break-back in injection pressure was noted to confirm the presence of fractures. However, this is not uncommon in unconsolidated sands. Screenout was obtained at the end and a wire-wrapped screen was washed into place to complete the job. This well has been on production for 16 months since this workover, and now produces 110 bbl. of fluid per day with 59% being salt water. Cumulative fluid since the workover is 45,000 bbl. No sand production has been noted, and fluid rates have been limited only by the allowable production.

Although there is only limited production history on the one job performed, further application of this technique appears justified.

Completing Through Casing

Experience has shown that sand can be controlled much more effectively in open-hole completions than in perforated casing. Thus, the best approach to successful sand control in casing would be to simulate open-hole conditions as nearly as possible. Three approaches are suggested:

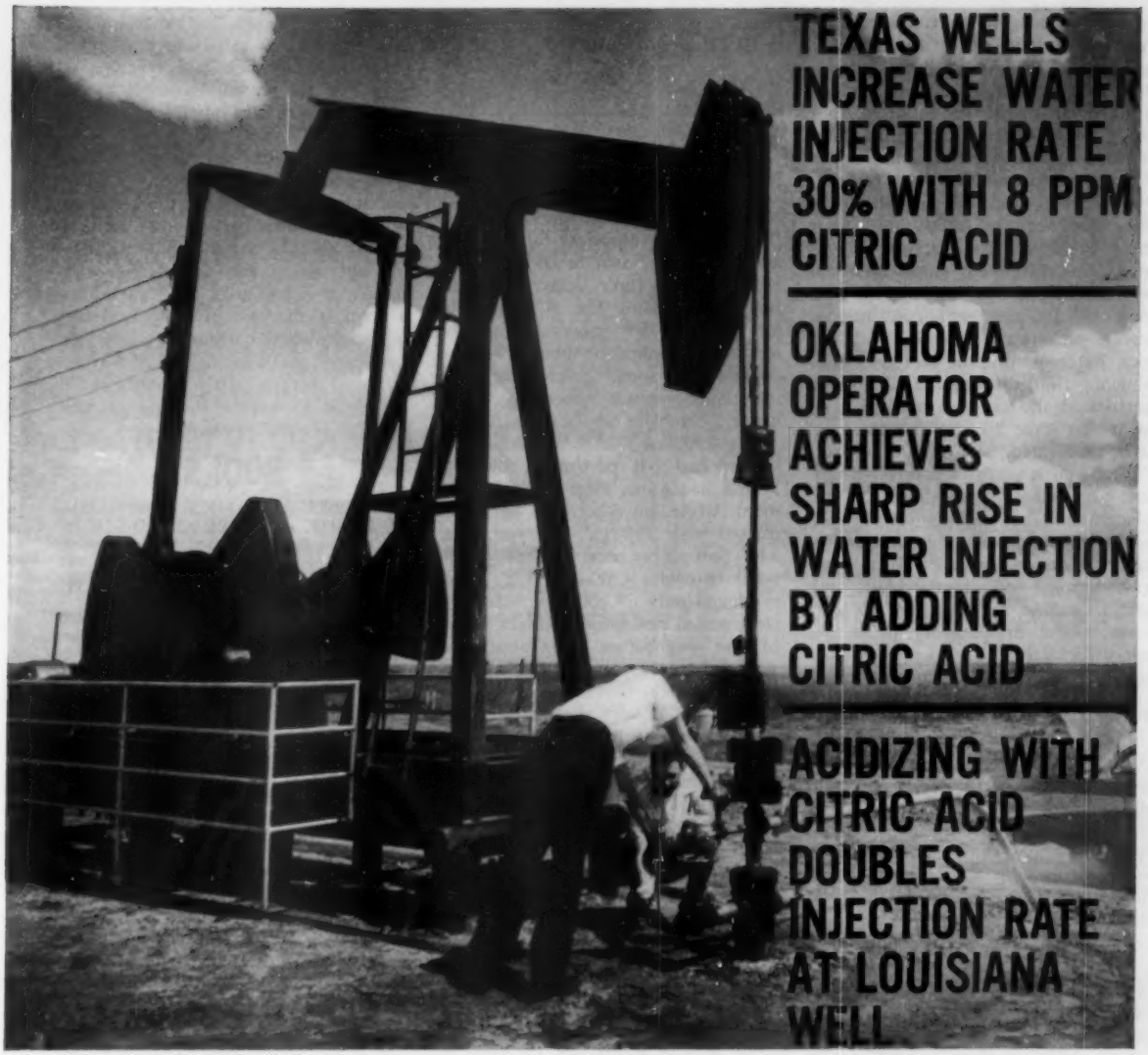
1. Milling out casing for completion instead of perforating.
2. Use of nonplugging completion fluid to assure that all perforations are open.
3. Use of greater perforation density in completion.

Milling out casing . . . This would restore an open-hole completion for screening. Because of the much better performance of open-hole completions, th[e] somewhat unorthodox technique merits consideration, particularly in small casing where there has been minimum success with sand control. It would apply only on initial completion in a zone, as remedial control has been poor in both open-hole and perforated-casing completions. With improved milling tools available and with savings in perforating cost, this technique should not add significantly to the cost of a recompletion.

Completion fluid . . . In those cases where milling is not considered advisable and completion must be made through perforated casing, use of a nonplugging completion fluid would help assure maximum distribution of flow over the screen or other control measure and thus approach as nearly as possible the advantage of open-hole completion.

Other studies have shown that completion mud forms a cone-shaped cake in the casing perforations. Under producing conditions, this pliable cake would flow back from at least a portion of the perforations, thus permitting production. If only a few perforations were cleared, even a nominal rate of production from the well would cause a strong jetting action on the screen, causing failure at that point. Failure would be most likely, as has been observed, when water appeared and fluid-production rates were increased. Examples of holes cut by a fluid jet are reported in the descriptions of some screens retrieved from the wells covered in this study.

Oil or formation water would be the most desirable nonplugging completion fluids as they would be least likely to damage the producing formation. As these fluids are frequently too light to balance formation pressures, use of heavier nonplugging fluids, such as calcium chloride and sodium nitrate solutions, will often



TEXAS WELLS INCREASE WATER INJECTION RATE 30% WITH 8 PPM CITRIC ACID

OKLAHOMA OPERATOR ACHIEVES SHARP RISE IN WATER INJECTION BY ADDING CITRIC ACID

ACIDIZING WITH CITRIC ACID DOUBLES INJECTION RATE AT LOUISIANA WELL

● Citric acid is making news at water injection operations all over the country. Extensive tests carried out at well heads have proven this fact: citric acid can prevent plugging that is caused by iron precipitates in injection water.

At two salt water disposal wells in Southern Texas, with average injection rates of 200 to 400 barrels per day, maintenance treatment with an 8 ppm addition of citric was started. In a short time, a 30% increase in flow rates was noted.

A well in Oklahoma was experiencing lowered injection rates because of iron plugged sandface. The well was acidized with a solution of 260 pounds of citric acid, 25 gallons of Triton* X-100, 250 gallons of 15% HCl and 500 gallons of water. This treatment dissolved and sequestered iron responsible for plugging. Injection rate rose from 50 bbl water per day to 400 bbl per day at considerably reduced pressures.

A water flood operation in Southern Louisiana had such a concentration of iron precipitates that they could not, economically, be kept in solution. Two wells were treated with two 400 pound batches of citric acid each, two weeks apart. Combined injection rates more than doubled, from 4,000 to more than 8,500 barrels per day, at last report. Also, the injection pressure has averaged 300 psi lower than previous requirements. These results were better than any previously obtained with hydrochloric acid treatments.

Other operators using citric acid have noted good results because of less frequent downtime on filters, and less replacement of parts because of rusting.

If you have been experiencing problems caused by iron precipitation in your injection water, write Pfizer for full information on the use of citric acid for iron sequestering.

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prove desirable. These fluids can be mixed to weights up to about 12 lb. per gal. Where use of these heavier fluids is not considered advisable, or still heavier weights are required, special equipment may be required to permit completion and screening under pressure with a nonplugging fluid.

Equipment for this purpose has been designed and used in at least three successful completions of this type. The equipment is essentially a conventional screen, open on the bottom, and equipped with conventional screen packers on both top and bottom. After spotting the preferred nonplugging fluid through the zone to be perforated, the screen is run and hung on tubing some 20 ft. above the zone to be perforated.

The well is perforated through tubing, the screen then lowered into place, and the packers set. Special wellhead equipment to permit movement of tubing under pressure is required. Some further experiment with this technique appears warranted in cases where nonplugging fluids are not sufficiently heavy to provide control in a conventional completion.

Perforation density . . . Increased perforation density using a nonplugging completion fluid should help to some extent to make perforated-casing completions approach open-hole conditions. As virtually all perforated-casing completions studied in this report were made with a density of four holes per foot, no comparison of densities can be made and no specific density can be recommended. Casing failures are often associated with sand-control difficulties, apparently resulting from removal of the supporting formation and sand-cutting action. Although increased perforation density would tend to weaken the casing, a reasonable increase in density might help provide more effective sand control and thereby reduce the incidence of casing failure.

Large Casing Completions

Under "Significance of Casing Size in Sand Control," experience shows that wire-wrapped screens offer the best prospect for success of any method studied in 7-in. and larger perforated-casing completions. More consistent success would be expected using nonplugging completion fluids and increased perforation density as discussed before.

Small Casing Completions

In 5½-in. and smaller perforated casing, there is some indication from limited experience that sand-consolidation plastic may have special application.

A breakdown of the three initial plastic jobs performed in perforated small casing is as follows:

	Cumulative fluid (bbl.)
Well S	117,000
Well Y	69,100
Well FF	998,000

Although none of the jobs was a complete failure, the one very large fluid producer accounts for the high average fluid shown in the statistical analysis. All three jobs ultimately failed by sanding up. Although the job on Well FF shows that plastic may have application in this type of completion, some improvement in technique appears desirable before making extensive application.

All three of the plastic jobs considered had 1-ft. perforated intervals. Well S had a one-stage 150-gal. treatment, while the other two jobs were treated with 250 gal. in two stages. The only difference evident in the latter two jobs is that Well Y, which produced only 69,100 bbl., was drill-stem tested and produced a quantity of fine sand before being plasticized, whereas the very successful Well FF was not produced before plasticizing. This is in line with the evidence that sand control is most effective when performed initially.

One limitation of plastic treatment for sand control is that with varying permeabilities in the producing interval it appears unlikely that plastic can be made to penetrate effectively through each perforation. Thus, when the well is placed on production, some of these poorly treated or untreated perforations could be expected to break down, particularly when there is substantial pressure drawdown under producing conditions. Thus, it would seem that a screen set through the producing interval after plastic treatment would offer some additional protection at these points. No high rate of fluid production would be expected from perforations which took little plastic, that fluid-cutting action on the screen at these critical points would be a minimum, and long screen life might be expected. There may be some risk of plugging the screen, as plasticized wells frequently produce fine sand initially and again at the appearance of first water.

The various packing techniques, including sand, gravel, and the more recent plastic-coated walnut shells, might offer alternate approaches to the problem of initial control in perforated small casing. However, the wells studied in this report offer no experience along these lines.

Further suggestions . . . The analysis suggested possible improved techniques for circumstances where experience has shown that no technique used was entirely satisfactory. A high-pressure sand pack and fracture is suggested for remedial control to reconstruct insofar as possible the initial sand conditions.

Use of a nonplugging completion fluid and greater perforation density are suggested to reduce the problem of initial failures and improve success in perforated-casing completions. Milling out casing and completing with screen in open hole is proposed as a possible alternate to perforated-casing completions where feasible. In perforated small casing use of a wire-wrapped screen after plasticizing is suggested to extend the life of this method of sand control.

BOOKS

PROCESS DYNAMICS — DYNAMIC BEHAVIOR OF THE PRODUCTION PROCESS. By the late Donald P. Campbell. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16. 316 pp. $10.50.

The book emphasizes a general approach to process dynamics by examining the characteristics of processes. Unsteady-state conditions are in response to periodic disturbances. Process design and control design are viewed as integrated problems in process systems. Use of linear network theory is presented as a means of predicting the dynamic behavior of a plant before it's built.

Some of the book's outstanding features include: (1) Applications of feed back control theory to chemical and petroleum operations; (2) the process-dynamics approach to automatic process control in the dampening of pressure and flow pulsation; and (3) the methods for controlling process operations involving moving filaments and webs.

BASIC GEOLOGY FOR SCIENCE AND ENGINEERING, by Edward C. Dapples. Published by John Wiley & Sons, New York. 609 pp. $9.50.

At a recent national meeting of geologists, one of the keynote speakers cautioned that the brightest hope for petroleum exploration may be for explorationists to revert to basic concepts. He said, in effect, that oil will be found by studying oil, gas, water, and rocks rather than investigating types of traps as extensively as in the past.

This volume outlines the basic principles of geology, as pertaining to its physical properties. It approaches the subject from a science and engineering viewpoint.

Physical properties classify each subject into three aspects: (1) observation and grouping of data; (2) classification of data into forms showing measurable relationships between properties, and (3) interpretation of the relationships to formulate behavior of geologic processes.

The chapters cover separate aspects, each well illustrated with pictures, diagrams, and charts. The reader should gain much from the respective topics of particular interest or from the book as a whole. It is an easy-to-read and well-prepared work. The subject is carefully and systematically developed.

Note: The Oil and Gas Journal maintains a book department. Write to the READER SERVICE DEPARTMENT, P. O. Box 1260, Tulsa 1, for copies of the book list. Often books reviewed here may be purchased from this source.

New index starts this month . . .

Journal readers now have figures on how costs of refinery operations are rising

STARTING in this issue and continuing in the first issue each month thereafter, the new Nelson Refinery Operating Cost Index will be published along with the customary Nelson Refinery Construction Cost Index.

The new indexes are based on the following proportions of the basic components of operating costs:

	Per cent	
	Refinery	Process units
Fuel	15	20
Labor	40	50
Investment	30	30
Chemicals	15	..

The cost of chemicals is not included in the index for process units. Thus if the cost of chemicals is important in a particular process, the cost of chemicals (or catalyst) can be handled separately.

Fuel components—This is an average of the following fuel cost indexes. However, the index for natural gas is counted twice in computing the average. This gives slightly different values from that described in Process Costimating No. 2 (March 3, 1958, p. 67).

Labor component—The index for wages is divided by the productivity of labor. The number of refinery workmen and their wages is published monthly by the Bureau of Labor Statistics in "Employment and Earnings." Slightly different labor cost indexes from the earlier years are shown in the more complete study of Process Costimating No. 41 (January 15, 1959, p. 163) because it included changes in fringe benefits and changes in the proportions of productive workmen to total employes.

Investment component—This represents the replacement value of the installation as well as interest (or dividends) on capitalization, property taxes and insurance, obsolescence, and to some extent maintenance materials. This component is simply the Nelson Refinery Construction Cost Index converted to a 1956 basis by dividing by 195.3.

Chemicals component — Based on the consumption and prices of the following major chemicals—tetraethyl lead, sulfuric and hydrofluoric acids, caustic soda, additives for gasoline and lubes, and catalysts for reforming, cracking, and treating. As other chemicals or processes become important, their effect will be introduced. Several issues of the Process Costimating Series will discuss chemical costs in detail (late 1959 or early 1960).

Nelson Refinery Cost Indexes

Published in the first issue each month in the Engineering Section.

Compiled by W. L. Nelson, Petroleum Refinery Consultant, Tulsa.

Charts of the indexes are published each year in a late January or early February issue.

Indexes of selected individual items of equipment and materials are also published on the Costimating page in the first issue of the month of January, April, July, and October.

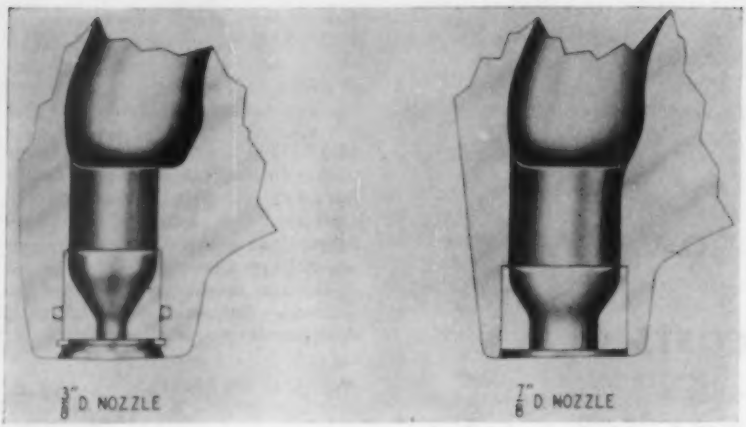
Refinery Construction Cost Index (1946 Basis)

Explained on page 101 of the issue of August 5, 1957.

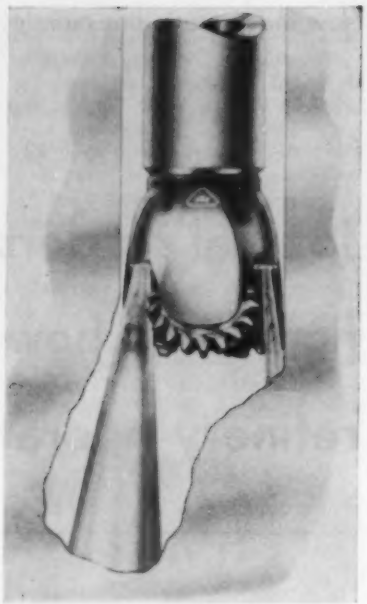
	1950	1954	1956	1957	1958	Feb. 1959
Pumps, compressors, etc.	138.2	166.5	192.0	206.7	214.7	226.4
Electrical machinery	134.9	160.0	175.0	188.9	192.7	193.3
Internal-combustion engines	126.0	150.5	164.0	173.9	178.3	178.8
Instruments	127.8	154.6	182.1	187.4	194.9	204.1
Heat exchangers	140.0	171.7	190.7	203.6	181.2	175.7
Misc. equipment average	126.2	160.7	180.5	192.1	192.4	195.7
Materials component	149.5	174.6	190.4	201.9	204.2	207.9
Labor component	144.0	183.3	198.2	208.6	220.4	226.6
Nelson construction index	146.2	179.8	195.3	205.9	213.9	219.1

Refinery Operating Cost Indexes (1956 Basis)

	1946	1952	1954	1957	1958	Jan. 1959	Feb. 1959
Fuel cost	49.6	81.0	86.5	112.4	102.6	103.8	105.7
Labor cost	73.1	88.7	90.9	106.1	105.0	96.7	97.1
Wages	52.4	81.5	88.7	104.1	105.4	108.5	109.7
Productivity	68 3	90.2	97.1	98.1	100.3	112.3	113.0
Investment, etc., costs	51.2	83.6	92.0	105.4	109.5	112.0	112.3
Chemicals cost	37.0	72.1	85.7	102.2	104.4	102.7	101.9
Operating Cost Indexes:							
Refinery	58.5	80.5	88.7	106.4	105.9	103.2	103.7
Process units	62.9	82.2	88.4	107.1	105.8	102.7	103.4



CROSS-SECTION comparing nozzles used in special tricone jet bit for hole deflection. (Courtesy Hughes Tool Co.). Fig. 1.



PRINCIPLE OF OPERATION of special tricone jet bit for hole deflection. (Courtesy Hughes Tool Co.). Fig. 2.

Jet-bit deflection saves money in directional wells

- Saves time in drilling surface holes
- Directional drilling rate is stepped up
- Use of costly extra equipment is avoided

BY ROY P. DWYER
The California Co., Venice, La.

THERE IS NOW a new method for deviating a well which, in many situations, can save much money.

This method, the "jet-deflection method," eliminates such tools as the whipstock, knuckle joint, and spud bit. Jet deflection also shortens the deflecting time common to these tools.

The jet method uses a conventional jet bit in which all but one jet is restricted. This single jet is as large as the rig's hydraulic system will permit. Circulating through the bit, then, erodes the well bore on the side and bottom in which the large orifice is oriented. Thus, the bit tends to deflect the hole in that direction. After, the bit has set a proper course, it can be used to drill ahead.

Article adapted from a paper titled, "Recent Advances in Directional Drilling," presented at 1959 spring meeting of API's Division of Production, New Orleans.

The jet-deflection method has cut the time required to drill surface holes by two-thirds. And, wells are being directionally drilled in only a few days more than a straight hole. When deflection is small, the hole may be deviated and straightened up in the surface hole at little more cost than drilling a straight hole.

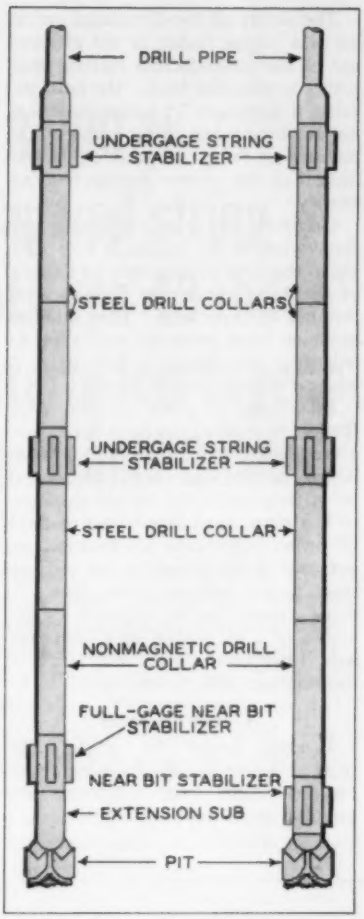
Old method is lengthy . . . Controlled directional drilling has become quite important in tapping oil lying under inaccessible or very costly surface locations. And, development of the tidelands along with the increase in townsite and river-bottom drilling has brought a boom in such directional drilling.

Until recently, the usual means of deflecting a hole meant using three types of equipment: the whipstock, the spud bit, and the knuckle joint. All these are costly in lost time resulting from tripping, changing bottom-hole assemblies, and circulating to condition the hole. Moreover, other equipment was necessary, such as bits, hole openers or pilot reamers, substitutes, small drill pipe, and monel pup joints.

There are also hazards with the older tools, most serious of which is sticking the whipstock. When this happens and the tools cannot be jarred loose, a costly fishing job usually results. A second danger when using a whipstock is premature shearing of the shear pin. This frequently occurs when running the tool into the hole. A third risk is possibility of being unable to get back into the rat hole made by drilling off a whipstock.

Another undesirable factor arises when using tools which have a predetermined deviation built into them. The hole must be drilled until the course is a tool set-off and then a tool run. This often makes a severe dog leg which can cause trouble later during drilling and completion.

The jet-deflection method makes a full-gage hole with gentle changes in direction and deviation. Moreover, the method saves time, bits, and extra equipment besides doing away with the hazards of the older tools. As the nonmagnetic drill collar is always in the bottom-hole assembly, the hole can



STANDARD JET deflection assembly, left, and normal drilling assembly, right. Fig. 3.

be surveyed with confidence at all times regardless of angle or direction. As conventional bits and bottom-hole assemblies do the deflecting, trips are much less frequent.

How method developed . . . There is tremendous energy in a fluid jet stream. And there is much idle hydraulic horsepower at hand on a rig. These facts suggested use of a jet method for hole deflection. Some rigs are handicapped with small pumps and engines, but more and more are changing to larger pumps for more efficient drilling.

The conception of this method was based on the knowledge of the tremendous energy available in a fluid jet stream and the idle hydraulic horsepower at hand on a rig. Although some rigs are handicapped with small pumps and prime movers, more and more are changing to larger pumps in order to drill more efficiently in all circumstances.

Initial field trial was made with a standard three-cone soft-formation bit with one 7/8-in. jet and two blank jets. The bottom-hole assembly consisted of an extension sub, near-bit full-gage stabilizer, and a nonmagnetic pup joint. Three hundred hydraulic horsepower was available resulting in 1,050 psi. with the bit at 700 ft. The formation was soft plastic shale or gumbo. After 30 ft. of jetting and drilling, hole angle was measured as 8¼°. This was subsequently reduced. Even though the initial field trial was made in a reduced hole that had to be reamed to full gage, the time to drill surface hole was cut 25%.

This test proved the principle. Later, the following improvements were successfully made, not necessarily in the order listed.

1. A full-gage hole drilled with two of the three jets plugged. However, this necessitated trips to pick up drill collars.
2. Two small jets (¼ or 1/8 in.) and one large jet (¾ or 7/8 in.).
3. A conventional drilling assembly with all drill collars and stabilizers. This is the normal bottom-hole assembly in use today.

Today's practice . . . It is now common practice to run a jet-deflection bottom-hole assembly if the deflection point is to be reached before dulling a bit. If the hole is to be deflected in the surface hole, the jetting assembly is made up (Fig. 1) and used to drill out the cement in the conductor pipe as well as any hole necessary to reach the deflection point. The same will hold true below surface pipe if only a few hundred feet of hole is to be drilled before jetting.

When the deflection point has been reached, the large jet (Fig. 2), is oriented in the desired direction and maximum circulation established. Smaller rigs can parallel their pumps while the bit is on bottom. The bit is lowered to bottom and all practical weight is put on the bit. Circulation is thus maintained for a time, depending upon the nature of the formation. The bit is occasionally slowly reciprocated in order to erode the wall of the hole and allow the bit to move in the desired direction.

In harder formations it is sometimes necessary to jet 15° to 20° either direction from the proposed direction in order to obtain enough erosion to allow the bit to deviate.

One to ten feet is then drilled before jetting is repeated. Drill collars with diameters in excess of 70% of the hole diameter are not recommended for deflection as they tend to be too rigid to allow the bit to deflect even though proper erosion is obtained from jetting. A ¼-in. horizontal deviation in 2½ ft. of vertical penetration will result in a change in angle of ½°. So, it is easy to see how little erosion is needed to change direction or angle.

Field Results

On routine wells in the Louisiana Gulf Coast area with normal deflection angles of 15° to 20° a directional hole can be drilled in 15 to 20% additional time over that required to drill a straight hole if the deflection point is not too deep. Higher or lower angles may require more time, as the angle is more difficult to maintain at higher angles and the direction tends to drift more at lower angles. In one field where 15½ days are required to reach total depth, the average time

TABLE 1—RELATIVE COSTS FOR A DEFLECTED SURFACE HOLE

	Jetting	Whipstock
Contract drilling*	$1,860 (30 hours)	$5,520 (90 hours)
Directional services	705	1,170
Bits and hole openers	540	1,710
Stabilizers	710	880
Nonmagnetic drill collar	75	150
Substitutes	60	180
Supervision	100	200
	$4,050	$9,810

*Based on a $1,450 per day rig.
NOTE: Mud cost not included.

TABLE 2—RELATIVE COSTS FOR 3,000-FT. DEFLECTION AT 10,250 FT. TRUE VERTICAL DEPTH

	Jetting and whipstock	Whipstock only
Contract drilling*	$32,000	$56,000
Directional services	3,640	6,100
Bits and hole openers	4,215	6,260
Stabilizers	1,100	1,500
Nonmagnetic drill collar	650	1,350
Substitutes	200	500
Supervision	900	1,700
	$42,705	$73,420

*Based on a $1,450 per day rig.
NOTE: Mud cost not included.

to drill a directional hole is 17 to 20 days.

Two wells drilled recently offshore with the same drilling rig from the same location are a good example. A straight hole was first drilled to 7,250 ft. in 9½ days with 99 rotating hours and five bits. A directional hole was then drilled with the objective of being out 2,050 ft. at a true vertical depth of 4,450 ft. and 3,765 ft. out at a true vertical depth of 7,250 ft. Both objectives were attained in 14½ days requiring 141 rotating hours and seven bits, even though 1,050 ft. more hole was drilled than for the straight hole. The hole was deviated at 500 ft., the direction and angle obtained, and surface casing set through the buildup. It was necessary to jet between 4,000 and 4,700 ft. in order to correct direction. Otherwise the hole was drilled to total depth without the necessity of further changes in course.

Tables 1 and 2 show the savings possible with the jet-deflection method. Table 1 shows average costs of deflecting and drilling a 15-in. surface hole using the jet-deflection method, as compared with using a whipstock. The figures are averages of several wells. Drilling fluids are not included in the breakdowns, as the daily costs of treatment vary greatly from field to field.

Table 2 shows the drilling costs for a 10,250-ft. true-vertical depth well. In some of the wells included under the jet-deflection method, one or two whipstocks were required at greater depths. The major factors involved are days required to drill and equipment used.

Other uses, too . . . The jet-deflection method has proved to be a valuable means of double-dog-legging a hole. This requires the deflecting, drilling, and straightening of a borehole in order to penetrate the producing zone or zones vertically. Casing usually is run after the hole has been straightened and the rest of the hole drilled normally. This practice can make large savings. Recently it required 40 hours to deflect a well 175 ft., whereas 15 hours are normally required to drill the same hole straight. It is estimated that a minimum of 4 days would have been required to accomplish the same objective with a whipstock.

Another practical use for the jet-deflection method is in side-tracking off a cement plug or from the low side of a directional hole. This is done in the same manner as deflecting the borehole. The bit used to dress off the cement plug can be used for deflection if the proper-size jets are installed and oriented before running the bit. Approximately 6 hours have been required to sidetrack off of a cement plug. In the case of an uncontrolled sidetrack in a straight hole where direction is unimportant, it is not even necessary to run a nonmagnetic drill collar.

No hazards, a few limits . . . To date, there are no known instances in which a fishing job has resulted from use of the jet-deflection method. However, the use of stabilizers in the drill-collar string is considered essential to prevent the differential sticking of the collars while jetting on bottom.

The jet-deflection method has given excellent results to a depth of 6,000 ft. However, at this point success decreases with depth. Good results have been obtained to 8,500 ft. with a conventional bit, but not with the consistency desirable. The factors which probably influence the erosion are decreasing bit hydraulic horsepower, harder formations, and the cushioning effects of the hydrostatic head on the jets.

The hydraulic horsepower available on a rig is a big factor in the speed with which a borehole can be deflected and sometimes in the success of the operations. An absolute minimum of 400 h.hp. can be used at shallow depths; however, unreliable results may occur. At least 700 h.hp. is recommended for success consistently.

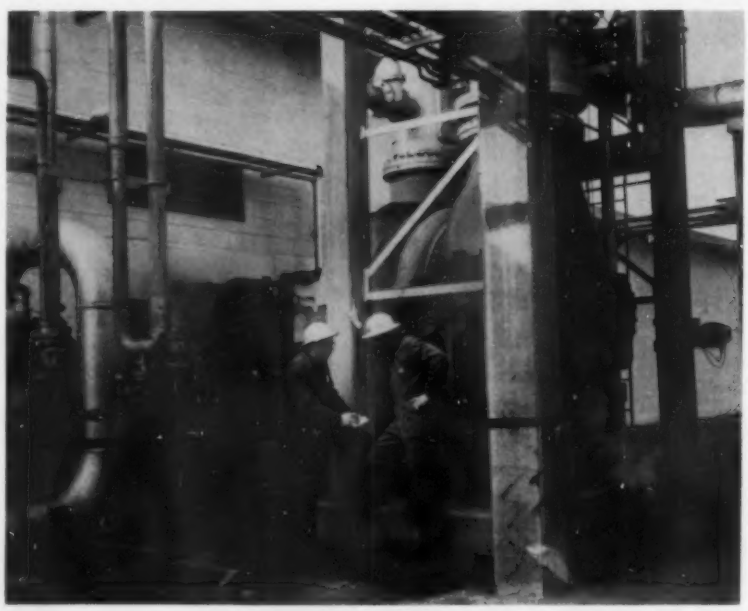
The ability of the directional operator is a bigger factor in the efficient use of the jet-deflection method than with conventional tools. He must develop a technique of jetting which is not required when using a whipstock. Success or failure depend on his selection of the proper bottom-hole assembly.

Originally, there was difficulty with the erosion of the approach hole leading to the large or orienting jet because of the large volume of fluid flowing through the approach. This situation has now been generally overcome by enlarging the approach hole (Fig. 4) and cementing the jet in place.

Practically all work to date using the jetting method has been done using a modified conventional bit. It is believed that the operational depths can be greatly increased by development of bits more adaptable to the method. Of prime importance are location and position of the orienting jet with respect to the bottom of the hole. As more knowledge is acquired of the action of a jet stream in a high-pressure fluid atmosphere, efficiency of this method will be extended.

Acknowledgment

Licenses under the jet-deflection method patent are available on a nonexclusive basis from California Research Corp.



New centrifugal compressor delivers 31,500 c.f.m. of air at 30 psig., to the new catalytic cracking unit at Leonard Refineries, Inc., Alma, Mich. The air is used in regeneration of the cracking catalyst. (Photo courtesy Cooper-Bessemer Corp.).

10,000-ft tapered string of Type 43 rods starts fourth year in Dennis-Gowdy

January, 1959 started the fourth year of steady service for a tapered string of Bethlehem Type 43 rods in the Dennis-Gowdy Well in the North East Purdy Field, near Lindsay, Oklahoma. The string consists of 5,600 ft of ¾-in., 2,300 ft of ⅞-in, and 2,100 ft of 1-in. rods. There have been no rod failures to date.

Operated by Magnolia Petroleum Company, the Dennis-Gowdy is one of the deepest producing wells in the N.E. Purdy Field. This is a dual completion, pumping from the Springer and flowing from the Hart. The pumping unit operates at 6 spm, using a 100-in. stroke.

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In addition to the Type 43 rod, Bethlehem produces three grades of carbon and alloy rods to enable operators to meet a wide range of pumping requirements.

If you have any question about which type of rod would be most economical for any given well, talk it over with your Bethlehem sucker rod distributor. Or drop a line to the nearest Bethlehem sales office.

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How to get the most out of your

Here are the things that cause wear, and how you can get longer service from this equipment item

DRILLERS often do not get as much life from the ram packers in their blowout preventers as they should. This article points out some ways that the packing life can be extended.

Here are some general rules:

1. The only measure of packer condition is the amount of rubber worn away. Closing under pressure may cause slight cracks in the packing; packing showing such cracks is just as useful as if new.

2. Most important cause of wear is manifold pressure for closing rams while the pipe is worked. This pressure should always be kept as small as possible.

3. When working the pipe with the rams closed, rotate and reciprocate slowly to get longest packer life.

4. Where possible, allow a small leak through the rams while working pipe. This will lubricate and cool the packing, thus making it last longer.

5. There is a limit to the shelf life of any rubber product. For that reason, ram packers and all other preventer rubber seals should be changed at least once each year.

Misunderstanding costs money . . . Many times, blowout-preventer-ram packers are discarded because the driller does not know how much that packer can take. This sometimes hides the fact that rams packers can be cheaper to use when working pipe under pressure than is an annular preventer or stripper rubber.

One type of ram and how its packing extrudes outward may be seen from the accompanying sequence pictures. These photos illustrate only the feeding action of the rubber. In sealing on pipe in use, of course, the rubber does not protrude past the retainer plates and is always fully confined.

The rubber wears by abrasion against the pipe. Worn rubber appears as a black powder. Occasionally a small piece of the rubber will come loose. As rubber is worn away from the ram, more feeds up to the packer face to keep a seal. Another photo on these pages compare a worn packer to a new one. Notice that when removed from pressure, the worn packer appears concave. But, when it was under pressure, the concave surface had been forced out flat against the pipe so that it sealed.

What causes wear . . . The main cause of packer wear is the pressure that forces it against the pipe. This pressure is made up of two parts. One, of course, is the pressure in the preventer closing manifold, and the other is the self-energizing or self-closing force caused by the pressure in the well. However, there are a number of other things that affect the speed of wear. The complete list is:

1. Well pressure. The higher the pressure, the more distortion of the rubber and the faster the wear.

2. Pressure in the closing manifold. Higher pressure means shorter life.

3. Speed and type of pipe movement. The faster the motion, the faster the wear. Reciprocation of the pipe is harder on the rubber than rotation.

4. Condition of the surface of the pipe. The rougher the surface, the faster the wear.

5. Amount of lubrication and cooling. Fluid purposely added or leakage can slow rate of wear.

6. Temperature of well fluid. Higher temperatures soften the rubber and increase wear in a small way.

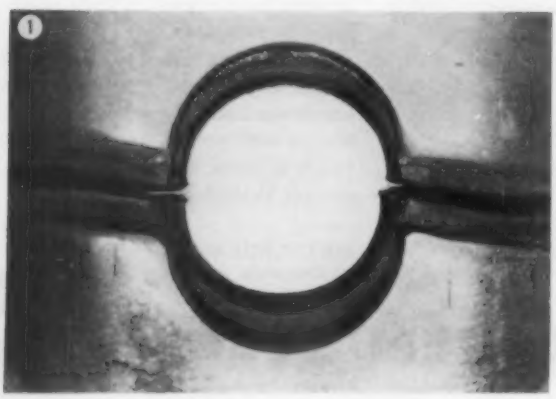
7. Composition of well fluid. Abrasive muds cause more wear than clear water.

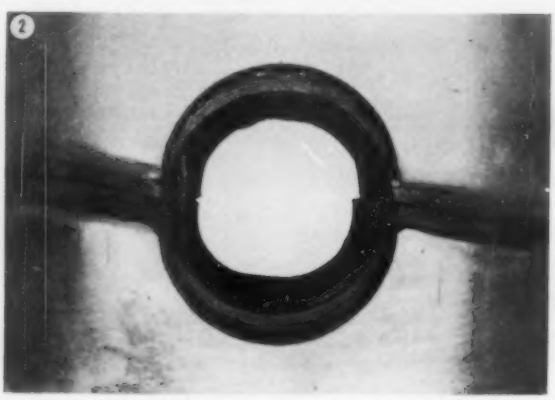
8. Type of rubber in packer. Scientifically compounded materials of today wear better than materials of times past.

9. Relation of pipe size to ram size. For a given size preventer, the larger the pipe size sealed by the ram, the shorter is packer life.

What we can, can't control . . . The driller can control some of these causes of wear; some he can't. The most important factor which he can control is closing pressure in the manifold. This should always be kept as low as possible. However, this doesn't mean that the driller should apply opening pressure to the manifold to decrease the self-feeding load if the preventer is designed this way.

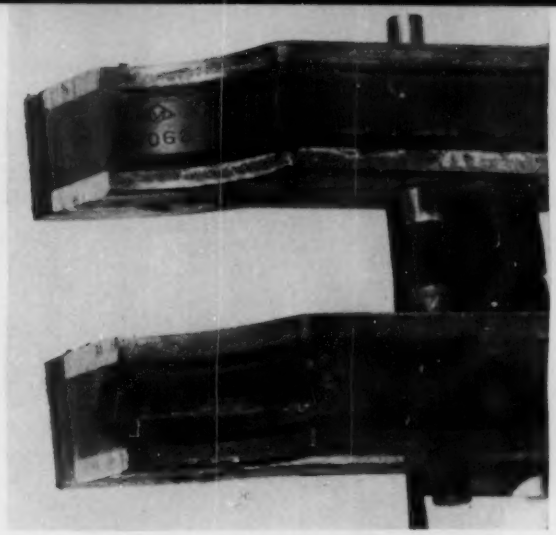
One type of ram and how its packing extrudes outward





blowout-preventer ram packers

BY M. C. LUCKY
Senior Engineer, Drilling Control Products, Cameron Iron Works, Houston



HERE'S how a worn packer, bottom, compares with a new one shown at the top.

When working pipe, don't apply opening pressure unless you intend to open the rams. Rams opened under well pressure always open with a snap. This can cause the driller to lose control of his well.

On the other hand, it is safe and desirable when possible to reduce the closing manifold pressure to zero. If this is done, a good precaution is to run in the locking screws to a point that they back up the rams without actually asserting a closing force.

If possible it is well to allow a small leak through the rams while working the pipe under pressure. This should not be a large leak, only about as much as a slow stream from a garden hose. When working the pipe, stop motion periodically and check to see that the packers will still seal absolutely tight. As the packers wear, it will take more pressure in the closing manifold to make a complete seal. Thus you can check on the condition of the ram packers.

For example, on one type of preventer, when the packers are new, pressure to close is less than 300 psi. When the rubbers are about three-fourths consumed, this pressure goes up to 1,500 psi.

One purpose of allowing a leak is to cool and lubricate the rubber. Another purpose is to make sure that closing pressure is no higher than absolutely necessary.

Move up, down if rotating . . . The driller has no control over the surface condition of the pipe in his preventers. Of course if the pipe surface is rough it will wear the preventer rubber faster than if it were smooth.

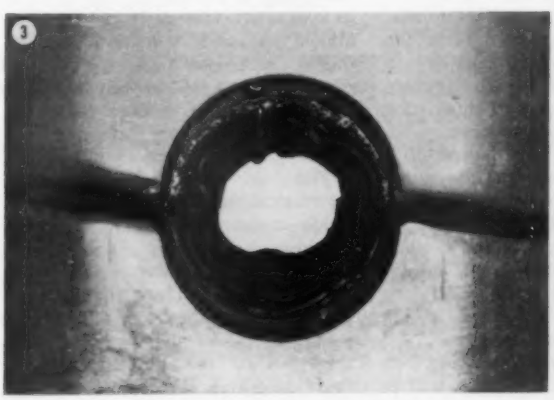
When pipe is rotated in the preventers for long periods, the packers polish the pipe surface with which it is in contact. After the pipe is thus polished, rotation can go on almost indefinitely without severe wear on the packers.

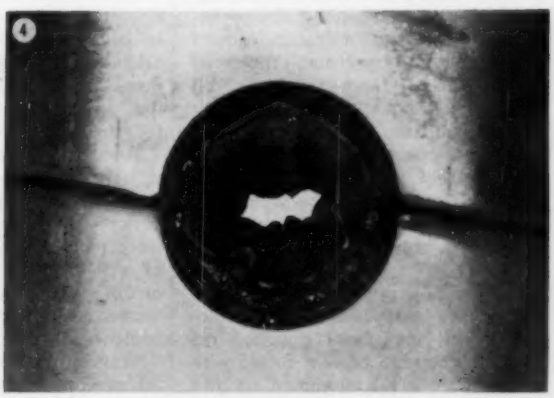
However, the pipe wears in this process. If the well fluid is abrasive, this wear eventually will damage the pipe. For that reason, when rotating it is best to move the pipe up or down a few inches occasionally so that wear is spread out over a greater area.

Because there can be little polishing action when pipe is reciprocated, this operation wears preventer packers faster than rotation. In either case, wear is slower when motion is slower.

In a given preventer size, all ram-packer sizes have approximately the same amount of feedable rubber. And the amount of wear depends on the area of packer in contact with the pipe. This means that, for a given preventer size, wear is faster with large pipe than with small. For example, in a 10-in. preventer, packers wear twice as fast on 4½-in. drill pipe as on 2⅜-in. tubing

Shelf life of all rubber is less in hot, humid climates than in cold, dry climates. But, in any climate, packers in service for a year or longer do not have full strength and wearability, regardless of their appearance. For that reason, ram packers and all other preventer rubber seals should be changed at least once each year.





This West Texas well was the proving ground as . . .

New fracture-acid method looks good

USE OF DRY CRYSTALS of sulfamic acid in fracturing fluid appears to be a promising method of increasing fracturing efficiency. It is felt that this treatment, being examined by Western Co., can combine a fracturing job with a penetrating acid treatment.

How it works . . . Once dissolved by water or brine in the formation, sulfamic acid crystals form an acid solution that dissolves limestone and dolomite deposits with the efficiency of hydrochloric acid, but the dry crystalline form offers other advantages.

Most crystals of sulfamic are smaller than the sand grains used in fracturing fluids. The crystals can therefore penetrate into the smallest fissures formed by the fracturing pressure—those too small to accept sand grains—as well as all other areas. Once there, they help to prop the crevice open when pressure is released, and dissolve surrounding rock as they are in turn dissolved by moisture in the formation. Each crystal eats away the area surrounding it, providing an open channel for oil flow.

Of greatest importance, the acid can dissolve particles of lime and dolomite which may have sloughed off the formation and become mixed with the fracture sand. Removal of this material from the fracture sand pack could result in a material increase in the permeability of the fracture.

Prolonged effect . . . Sulfamic permits continuous acidizing over a long period of time. The solubility of these crystals is approximately 18% at room temperature, increasing to 30% at 160° F. While some of the crystals dissolve immediately in the moisture present to form an acid solution, the excess remain in solid form. These provide a reserve that continuously replenishes the strength of the acid solution as it is used up in reaction with the formation. Under some conditions this process could go on for months. In contrast to some other acids, the calcium and magnesium salts of sulfamic are much more soluble than the acid itself, virtually eliminating the possibility of redeposition.

Another plus offered by these crystals is that they keep the fracturing fluid on the acid side for a longer period of time. This is important since acidity prevents the swelling of clays frequently found in oil-bearing strata, and also inhibits the formation of iron hydroxide which could be harmful as a scale.

Western's attempt at fracturing with sulfamic proved successful. A well in the Permian basin was treated with 4,000 lb. of acid in four stages. Immediately following treatment, the well produced 120 bbl. per day. After 5 months, the well was still producing 90 bbl. per day. By contrast, an offset well was fractured in the conventional manner and stabilized at the field average of 15 bbl. oil per day.

Another experiment was performed on a wildcat well which was subsequently plugged and abandoned due to lack of commercial petroleum reserves.

Safe, easy to handle . . . Because of its extremely low corrosive rate, inhibited sulfamic is helpful in minimizing acid attack on casings and pump parts. Even at elevated temperatures no fuming takes place, and the dry granules are safe and easy to handle.

There are some limitations regarding the successful use of fracturing fluids containing sulfamic crystals. Moisture must be present in the formation. While this is true in the majority of cases, there may be situations where the lack of moisture would not allow the crystals to dissolve. Also, the oil-bearing strata must contain acid-soluble rock.

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HUMBLE

Process operating costs—caustic washing

BY W. L. NELSON
Technical Editor and
Petroleum Consultant

CAUSTIC WASHING is used extensively to remove hydrogen sulfide from propane, butane, and straightrun gasoline, naphthas, kerosine, and distillates. In some instances the washing is conducted as part of another treating process and in such cases one does not know whether or not to assess a cost for caustic washing or to consider the cost as part of the other process. It is used less extensively in connection with cracked gasolines or naphthas, especially when processing high-sulfur crude oils because the amount of hydrogen sulfide is so large that the bulk of it must be removed by regenerative types of gas desulfurization. Little caustic is now required to neutralize acid-stage (sulfuric acid treated) oil.

Table 1 shows the small costs for labor, maintenance, investment, etc., (only 0.5-1.3 cents per barrel) but the largest cost of all, that is, caustic soda, varies so widely that it must be assessed separately.

The amount of hydrogen sulfide dissolved in crude oils is about:

	Weight per cent
Sweet oils	0.00005-0.0006
Sour (stabilized)	0.0005 -0.003
Sour	0.0006 -0.05
Highest reported	0.15

This finds its way to a considerable extent into the bottle-gas and lighter straightrun products during topping as indicated in Table 2. Note that most of the sulfide stays in the topping-still gas. Large amounts of hydrogen sulfide are produced during thermal and particularly catalytic cracking, resulting in gases that contain up to even 15% of hydrogen sulfide. The equilibrium ratio of sulfide (5 to 20 for various conditions) results in the approximate weight percentages of sulfide in gasoline shown in Table 2. The literature offers only the following scant information:

	Lb. caustic per bbl.
Neutralization in topping	0.04
Acid treated cracked gasoline	0.1-1.0
Acid treated kerosine	1.0-3.0

and hence the data of Table 2 had to be computed. No adequate way of checking the values was available because of the reuse of partially spent caustic and because of doubt about how much desulfurization was done by means of other processes, but in general the figures of Table 2 result in consumptions of caustic that appear to check with the amount of caustic used by the industry, namely:

	Lb. per bbl.
1930	0.20
1941	0.14
1948	0.16
1956	0.17
1956	0.18

TABLE 2—APPROXIMATE AMOUNTS OF SULFUR (AS HYDROGEN SULFIDE) IN GASOLINES AND NAPHTHAS

	Per 1,000 bbl. product	
	Lb. sulfur	Lb. caustic required
Straightrun distillates to 550° F.:		
From sweet crude oils	0.5-2.2	0.6-2.7
From stabilized sour crudes	0.47-13.2	5.9-16.5
From sour crudes	6.1-216	7.6-270
Cracked gasolines from 0.5% S, M.-C. crude	75- 468	94- 580
From 0.8% S, Venez. crude	66- 318	84- 396
From 1.0% S, W. Tex. crude	75- 333	94- 416
From 1.5% S, M.-C., Venez., M.E.	112- 865*	140-1,085*
From 2.0% S, W. Tex. or Venez.	135- 840*	170-1,050*
From 3-4.5% S, M.E. or W. Tex.	226-1,870*	282-2,340*

*Sulfide usually removed by a regenerative-type desulfurization process so that only a small amount of sulfide need be removed by a final caustic wash.

TABLE 1—ELEMENTS OF OPERATING COSTS—CAUSTIC WASHING

Element—	Unit (somewhat standard)	1956 unit cost	For 10,000-bbl. per day plant (cents per bbl.)	See Process Costimating No.
Labor: Supervision	0.1 man per 8-hour shift*	$3.85 per hour†	0.06-0.37*	26, 28, 41
Operating	0.33 man per 8-hour shift*	$3.12 per hour†	0.16-0.99*	
Maintenance	2-3% per year of replacement	$5-$12 per daily bbl.‡	0.033-0.049	29
Power	0.0005-0.0009 b.hp. per bbl.	21.6 cents per day§	0.011-0.019	13, 14, 21-23, 36
Direct cost without caustic (probable extremes)			0.4-1.1	
Caustic soda	0.002 to 0.6 lb. per bbl.	4.1 cents per lb.	0.01-2.46	
Total direct cost (probable extremes)			0.6-3.0	
Laboratory control	0.1 man per 8-hour shift	$3.12 per hour†	0.07	
Obsolescence, insurance, taxes and interest (6% per year of replacement)			0.10	

*Small independent refiners use about one-third as many men whereas majors use about twice as many as shown. †Average U. S. wages including 27% for all burdens. ‡For size range of 2,000 to 20,000 bbl. per day. The cost of a 10,000-bbl. per day plant is about $6 per daily barrel. §For electricity at 9 mills per kw.-hr. Steam-driven pumps could increase the cost tenfold.

HERE'S PROOF* . . .

BOSTON'S *B-228* PROCESS MORE THAN DOUBLES O.S.&D. HOSE RESISTANCE TO SUN AND WEAR!

You are looking at dramatic proof that the new B-228 Process developed for the covers of BOSTON Oil Suction and Discharge Hose more than doubles resistance to sun, abrasion and tearing! Each of these two swatches of O.S. & D. Hose covers has aged for exactly the same length of time. The upper swatch from the BOSTON cover is as good as new. The lower swatch from the ordinary cover is cracked, torn, and deteriorated.

This is news. This is important. Now BOSTON'S new B-228 Process provides entirely new protection against 90% of O.S.&D. Hose failures. Without question, BOSTON O.S. & D. Hose can sharply cut your hose replacement cost. Specify BOSTON next time you buy!

228% GREATER RESISTANCE TO SUN DAMAGE

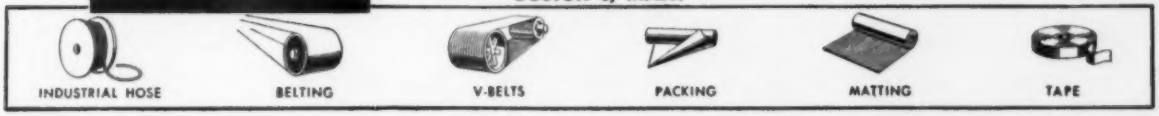
212% GREATER RESISTANCE TO ABRASION

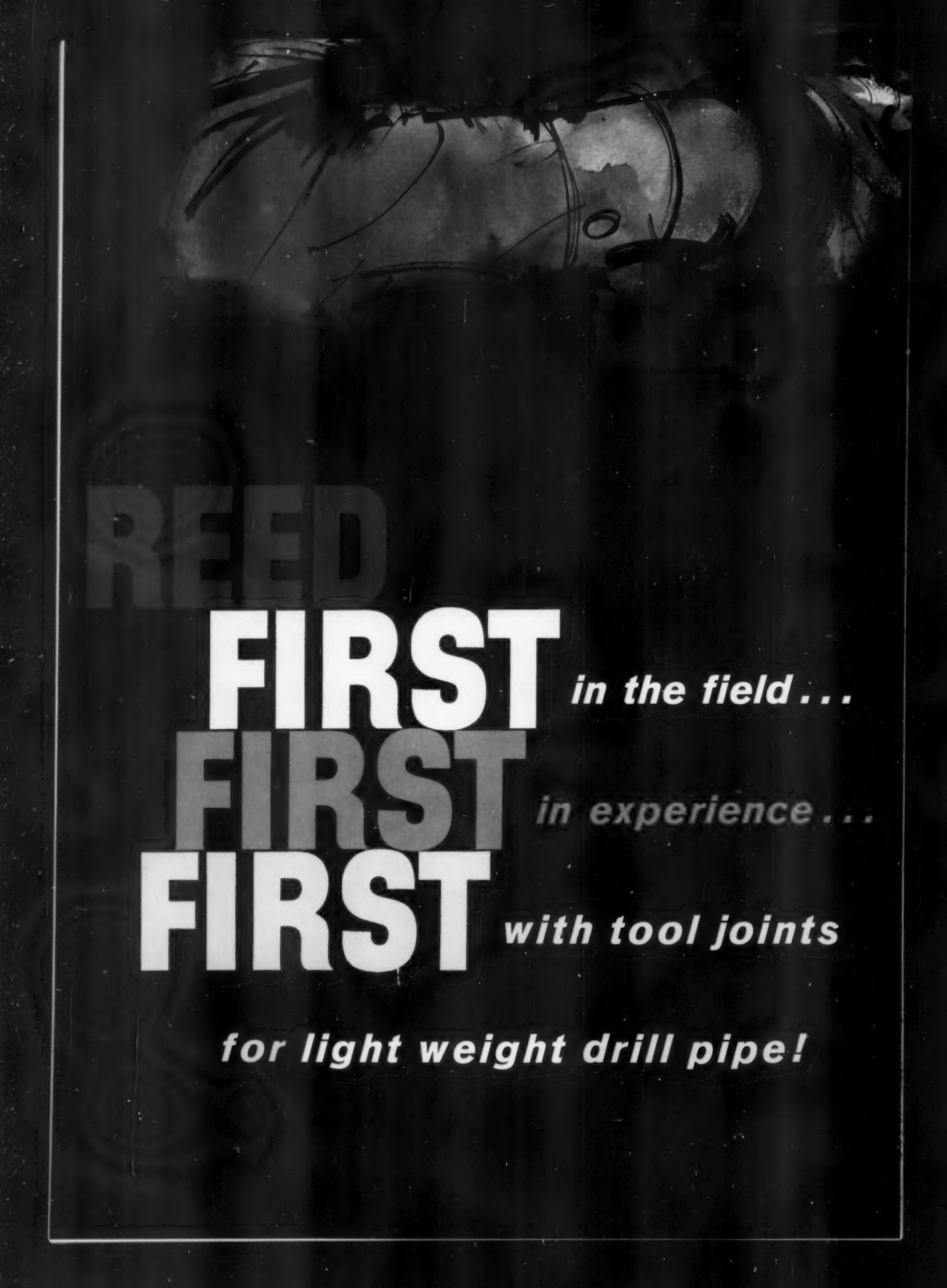
207% GREATER RESISTANCE TO TEARING

*Unretouched Photograph

BOSTON

BOSTON WOVEN HOSE & RUBBER COMPANY
DIV. OF AMERICAN BILTRITE RUBBER CO., INC.
BOSTON 3, MASS.



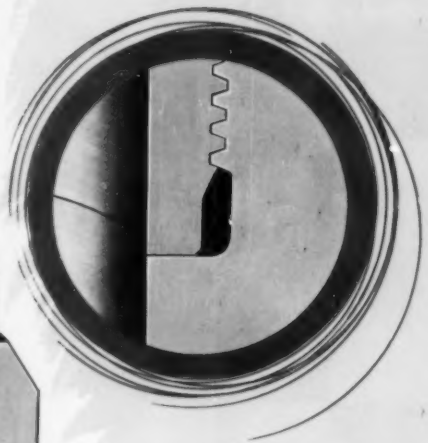

REED
FIRST in the field . . .
FIRST in experience . . .
FIRST with tool joints
for light weight drill pipe!

Reed was designing and making tool joints for light weight pipe as early as 1948.

Reed Wide Open tool joints have been *proved* in the field on more than two million feet of drill pipe. Some light weight strings with Reed Wide Open joints have made more than 300,000 feet of hole.

Naturally you want the best tool joints made for your light weight drill pipe. The answer is Reed-designed Wide Open tool joints — tested and proved in the field, interchangeable in most sizes with API internal flush working connections, with an I.D. that matches the I.D. of light weight drill pipe.

Only Reed offers a tool joint that is right for every drilling need. When you buy tool joints, buy Reed!



The Reed end seal is stronger in torsion then the pipe body. The mating end seal design assures positive shoulder seal contact . . . no threads to interfere.

REED

SUPER SHRINK-GRIP AND FLASH WELDED

TOOL JOINTS

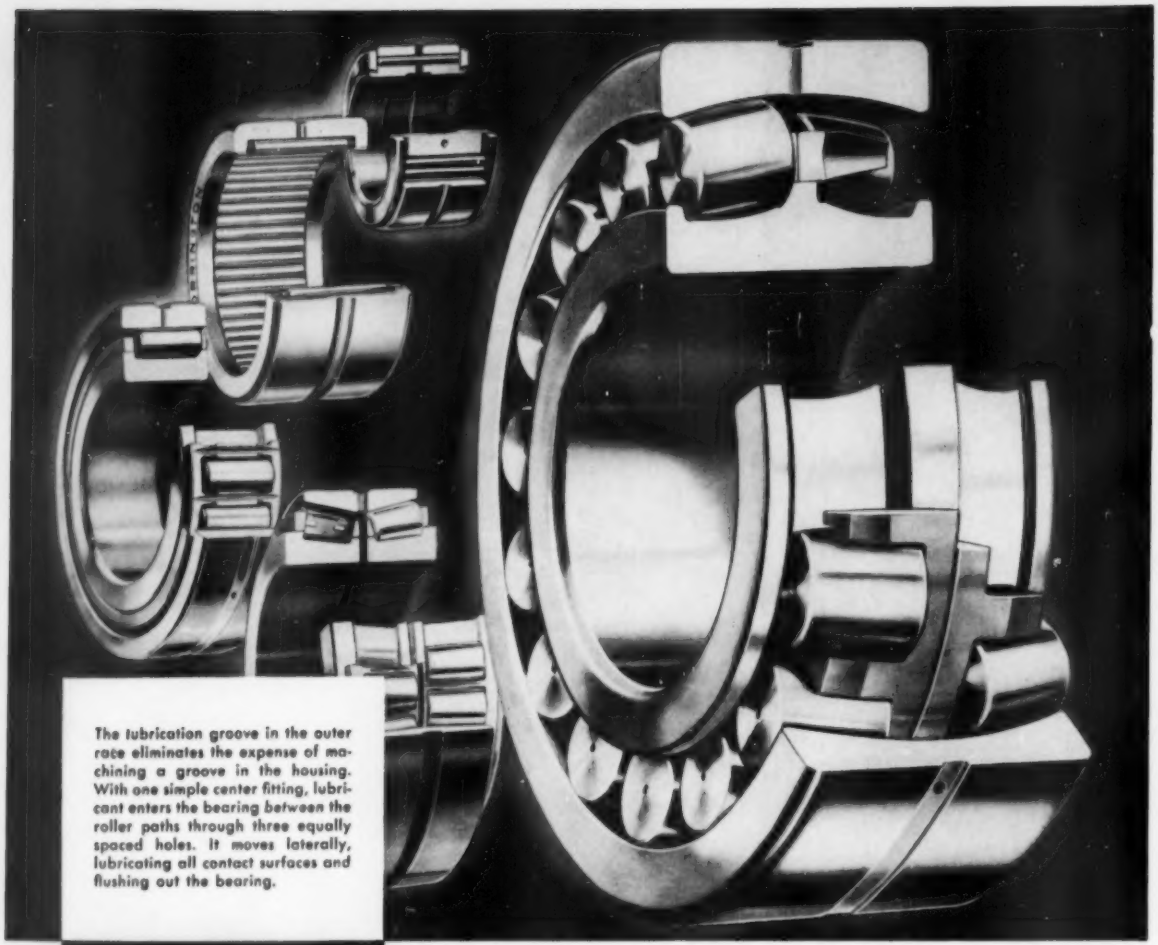
REED ROLLER BIT COMPANY

Houston 1, Texas

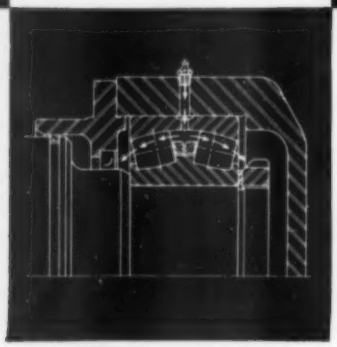
EXPORT OFFICE: 1011 INTERNATIONAL BLDG., NEW YORK 20, N. Y.

GULF COAST, MID-CONTINENT, ROCKY MOUNTAIN AND CANADIAN DISTRIBUTOR for MARTIN-DECKER PRODUCTS.

REED'S ROLLIN'



The lubrication groove in the outer race eliminates the expense of machining a groove in the housing. With one simple center fitting, lubricant enters the bearing *between* the roller paths through three equally spaced holes. It moves laterally, lubricating all contact surfaces and flushing out the bearing.



A time-proved lubricating method now available on Torrington Spherical Roller Bearings

The circumferential groove in the outer race has met the test of experience in many Torrington Bearings, including Heavy Duty Needle Bearings, Aircraft Type Needle Bearings, Tapered and Radial Roller Bearings. Now the circumferential lubrication groove is available in Torrington Spherical Roller Bearings.

This design feature makes it possible to introduce lubricant *between* the roller paths without the expense of machining a groove in the housing. This groove is proportioned to provide generous lubricant flow capacity. Lubricant moves through the roller paths, flushing used lubricant and contaminants away from bearing contact surfaces.

Torrington Spherical Roller Bearings in many sizes may be ordered with this groove as desired at no additional cost. For further information, see your Torrington representative or write: **The Torrington Company, South Bend 21, Ind.—and Torrington, Conn.**

TORRINGTON BEARINGS

District Offices and Distributors in Principal Cities of United States and Canada

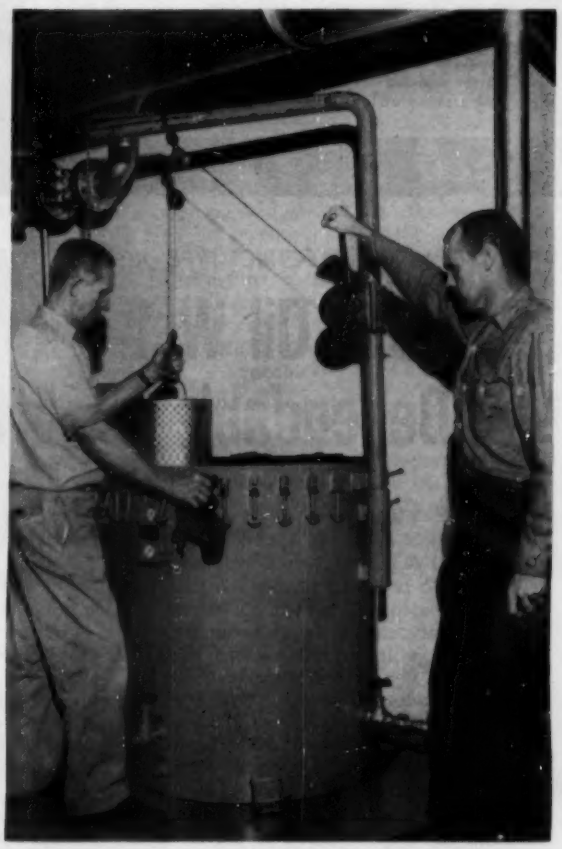
SPHERICAL ROLLER • TAPERED ROLLER • CYLINDRICAL ROLLER • NEEDLE • BALL • NEEDLE ROLLERS • THRUST

Small hoist eases filter change

At Northern Natural Gas Co.'s Hugoton compressor station, removing cartridges from an oil filter was an arduous and dangerous task. One man had to straddle the filter and lift, one at a time, seven cartridges from the cylinder. Usually, a helper assisted from floor level.

But now things are different . . . no strain, no pain. A steel arm was fabricated to fit into a socket which was welded on the side of the filter. By attaching a winch to the arm, the cartridges are hoisted out and lowered with a minimum of effort.

REPLACING oil-filter cartridges is a tough job by hand. At Northern Natural's Hugoton compressor station, it used to be done like this, with Oiler Archie Fruits lifting the cartridge from the top while Harley Nordyke assists.



NOW things are different. Using a homemade invention which eliminates the hazards, one man merely works the crank while the other guides the cartridge. This has meant a real saving in energy and has provided extra safety factors for workers.

Only Known Motor Specifically Designed for Oil Well Pumping
HIGHEST MOTOR SLIP lets counterweight inertia absorb the shock of the rig's sudden peak loads—not the motor!
HIGHEST STARTING TORQUE provides the extra power needed to always start the rig. Stalling is now eliminated!

NEW GENERAL ELECTRIC TYPE KOF MOTOR NOW MAKES POSSIBLE . . .

Lowest Oil Well Pumping Cost Per Barrel; Dependable, Unattended Rig Starting

General Electric's new Type KOF motor is the only known motor designed specifically to handle the unusual load demands of oil well pumping rigs!

Eight- to ten-percent slip—highest of any oil well pumping motor—lets the rig's inertia smooth out load and current peaks that often damage ordinary motors and cause voltage fluctuations. This means lowest kw-hr cost per barrel pumped!

Four-hundred-percent (400%) starting torque gives General Electric's new Type KOF the extra power needed for dependable starting on unattended rigs. Highest starting torque prevents stalling and costly motor burnout!

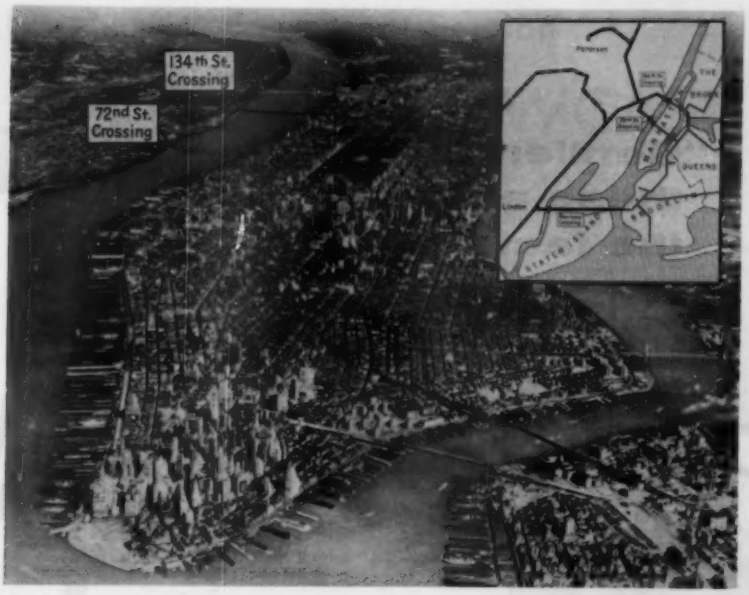
No other motor has been designed so completely around the requirements of the oil well pumping application. For the full story call your authorized motor distributor or nearby Apparatus Sales Office; or write direct to Section 899-4, General Electric Co., Schenectady 5, N. Y.

Compare General Electric's New Type KOF Motor

	Starting Torque	Motor Slip	Double-end Ventilation	762-volt Connection	Regreasable Design
General Electric (Beam-type Pumping Motor)	High	8-10%	Yes	Yes	Yes
Manufacturer "A" (NEMA C)	Low	2-3%	No	No	No
Manufacturer "B" (NEMA D)	Med.	5-8%	Yes	No	Yes
Manufacturer "C" (NEMA D)	Med.	5-8%	No	No	No

Progress Is Our Most Important Product

GENERAL ELECTRIC



On the Job

PIPELINING

Across the Hudson River are new . . .

Twin pipelines for New York

THE THIRD underwater crossing of the Hudson River is being made by Transcontinental Gas Pipe Line Corp.

The crossing is comprised of two parallel 24-in. lines. The project will mark the first time that two lines have been pulled simultaneously across a major river. Samuel Gallucci & Sons, Inc., the prime contractor, and Collins Construction Co., are installing the crossing.

The plan involves pulling the dual system by a winch located on the New Jersey shore. Pipe will be launched from Seventy-second Street in Manhattan and will extend to North Bergen, N. J., connecting Transco's 1,840-mile gas system with a new link to the New York metropolitan area.

The crossing is part of a $115,000,000 expansion program by which Transco will boost daily sales-delivery capacity to 1,636 M.M.c.f., including underground storage. Deliveries to the New York area will be increased by 106 M.M.c.f.d., or 35%, to 431 M.M.c.f.d.

Previous crossings . . . Transco's first crossing at 134th Street, Manhattan, was completed in 1950 and made possible the delivery of the first natural gas to New York City January 16, 1951. The second crossing, made under the Narrows of New York Harbor, from Staten Island to Brooklyn, was completed in 1952.

The new lines will tie in near Seventy-second Street with a new Consolidated Edison line which crosses Manhattan, thereby providing a link with other utilities in the New York, Brooklyn, Staten Island, and Long Island area which are interconnected with ConEd.

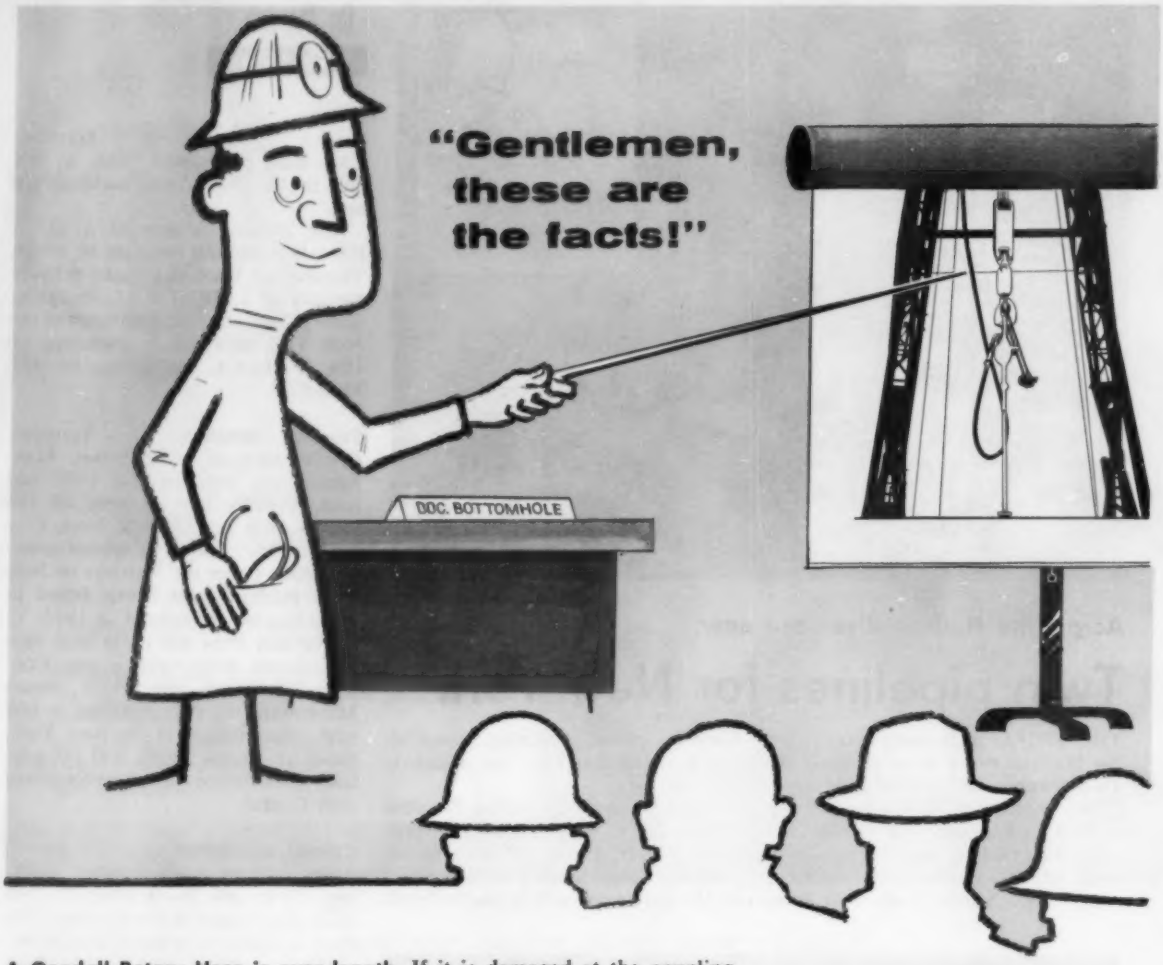
Current installation . . . The pipe is 24-in. o.d. by 0.500-in. wall weighing 450 lb. per ft. A total of 8,500 ft. of pipe is used in the crossing. (The river is 4,200 ft. wide at this point.)

Pipe is coated with a 1-in.-thick asphalt mastic and 2-in. of reinforced concrete. Standard 40-ft. joints are welded into 160-ft. sections.

Launching is from a ramp designed by Collins. The pipe rides on twin sets of rubber-tired wheels. Pulling caps are welded to the pipe ends (see photograph) and a yoke is attached to both caps with a center eye for single-cable pulling. A haulback cable, attached to the yoke for control and tension on the pulling cable, is connected to the winch on the New York side of the river.

Steel pontoons, each 12 ft. long and exerting 1,200 lb. lift, are strapped to the pipe with steel bands and enable the heavy pipe to be eased to the bottom. Pipe supports are located 60 and 120 ft. from shore to aid in lowering in. The trench is 20 ft. wide and 25 ft. deep, thus the pipe rests about 75 ft. below mean low tide. Buoys mark each pontoon so that when laying has been completed, a boat hauling on the buoy line cuts the steel straps, freeing the pontoons to float to the surface. The crossing is backfilled with sand.

WORKMEN in boat prepare to bolt down flotation tank on gas pipeline.



A Goodall Rotary Hose is over length. If it is damaged at the coupling, you don't have to replace it. Goodall will repair it good as new for $125—and you still have a standard API length hose. If the hose is crushed in the middle, Goodall will make a two-piece rotary hose from the damaged sections for $350. From a salvable Goodall Rotary Hose, you can get one or more API vibrating hose for as little as $125 each. When you have received all possible use from your Goodall Hose, you get $50 credit by simply returning the used set of Barney Couplings.

When selecting your next rotary hose remember: Goodall's Long-Life Rotary Hose is the best hose made for the high pressures and abuse that today's rotary hose must take . . . and no other hose offers such outstanding economy.

These exclusive features are available *only* with Goodall Long-Life Rotary Hose:

The Barney Coupling

The Goodall Safety Clamp

The Goodall Repair Service

The Goodall One-Year Guarantee

GOODALL RUBBER COMPANY

TRENTON, N. J.

Goodall Rubber Company of Texas: Houston, Odessa and Wichita Falls.

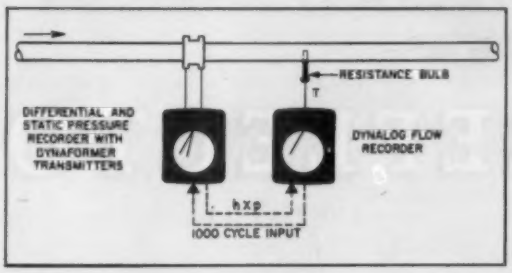
Goodall Rubber Company: New York, Philadelphia, Pittsburgh, Chicago, Denver, St. Paul, Detroit, San Francisco, Los Angeles, Seattle, Salt Lake City, Portland, Boston, Indianapolis, Kansas City, Milwaukee, Stuart, Miami, Charlotte, Atlanta, Toronto. (Petroleum Rubber Ltd., Calgary, Edmonton).

Export: Goodall Rubber Company, Trenton, New Jersey.

Stocking Distributors: Texas and Louisiana — Houston Oil Field Material Co., Wilson Supply Company, Hunt Tool Company; Oklahoma and West Texas—Iverson Supply Company; Stocking Representatives: Heap Equipment Company, Odessa, Lee Franks, Wichita Falls.

▶ ▶ ▶ New Equipment Section

This week's SHOWCASE features . . .



Gas-flow computer

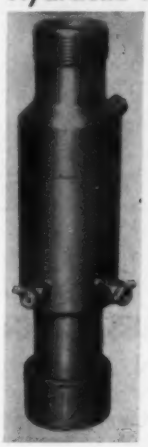
. . . gives continuous flow data for dispatching. Units for single and multiple meter runs are included in this newly developed system for gas distribution and transmission. The systems come as a complete cabinet or panel-mounted package. This includes piping, wiring, and calibration under simulated operating conditions.

The computer solves the flow equation and provides a chart of corrected flow. Correction for gas temperature is automatic. Corrections for supercompressibility and specific gravity can be manually set.

The maker recommends the systems for installation at the meter station rather than the main office so only one computed value need be telemetered to the dispatcher. This can give higher accuracy and save transmission-line space and cost as well as main-office space.

The computing system uses a static pressure element and two transmitters. By means of the transmitters, the differential and pressure measurements are converted to electric voltages proportional to the corresponding values. The transmitters are wired to produce an output voltage proportional to the product of differential and static pressures. This voltage is one of two inputs to the flow-recorder computer. The second input is from a resistance bulb that measures gas temperature. The use of a square-root chart on the recorder gives flow rate corrected for pressure and temperature. **Contact Manufacturer: Foxboro Co., Foxboro, Mass., for details on gas-flow computer.**

Hydraulic wire-line valve



. . . with a 10,000-psi. working pressure is now on the market. Tested to 20,000 psi., the valve has been designed and is particularly suited for lubricator setups that employ a single-strand wire line. One outstanding feature of the valve is that, without changing the sealing segments, the valve will effectively close on itself and perform as a valve when the tools are out of the hole. The valve is normally actuated with a hand pump. But it can be actuated with hydraulic pressure supplied by service trucks.

Special high-pressure seals are provided at every point of pressure contact. The valve comes with 20,000-psi. lubricator unions. But other suitable unions can be obtained on special order. **Contact Manufacturer: Bowen Itco, Inc., P. O. Box 4587, Houston 13, for details on hydraulic wire-line valve.**

Recorder for drilling rigs

. . . charts three variables simultaneously—rate of penetration, drill-string weight, and torque. One of the most recent developments for well logging, the instrument measures rate of penetration mechanically. It can be used to obtain precise information on time elapsed for each foot of hole drilled, the number of feet drilled an hour, total depth, formation changes, and drilling and non-drilling or down time.

A hydraulic system is used to obtain total drill-string weight in suspension, weight on bottom, and changes in weight. A hydraulic system also is used to determine torque. The measurements of torque can be used to pinpoint tight spots in holes and to indicate locked cones.

Among the benefits of the instru-

Send this **Showcase Coupon**

to the **Manufacturer** of the item in which you are interested. See name, address, and equipment name and/or model, in bold-face type at end of description.

NAME AND/OR MODEL NUMBER.....

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HOT WEATHER FASHION SHOW

The Coolest Pipe Lines This Season Will Wear—

REFLECTO

(WHITE)

Nicolet REFLECTO (White) reduces enamel temperature as much as 30°F. This added protection will keep the enamel at a uniform thickness all around the pipe.

Independent research laboratory tests prove that, under controlled surface heat of 140°F. enamel beneath black felt registered 156°F. Enamel beneath REFLECTO (White) registered 126°F. — **a temperature reduction of 30°F.**

In addition, use on many domestic and foreign jobs has proven the worth and versatility of REFLECTO (White) in a great number of applications. Stocking problems have been solved and considerable transportation savings effected.

Nicolet REFLECTO (White) weighs 10 lbs. per 100 sq. ft., is reinforced with ¼" spaced parallel glass strands, has Neoprene built right into the sheet — not impregnated or coated — and has a high resistance to scuffing and atmosphere moisture.

Put REFLECTO (White) to work for you now — it's not too late to specify REFLECTO on this Summer's lines. Write, wire or phone today.

NICOLET INDUSTRIES, INC.
Florham Park, N. J.

Norristown, Pa. Hamilton, Ohio

DISTRIBUTED THROUGHOUT UNITED STATES.

ment is that it provides an easy-to-read chart that can be analyzed for drilling efficiency to provide data for more intelligent bidding and for better-planned drilling programs on future wells.

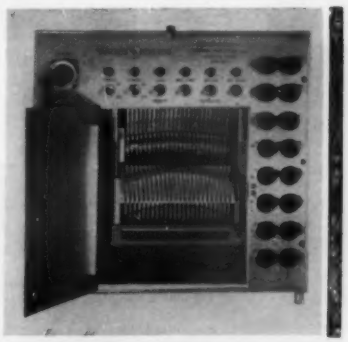
The drilling recorder is available on a daily rental or term-lease basis in the United States and available for purchase in export markets. **Contact Manufacturer: Technical Oil Tool Corp., 1057 North La Brea Avenue, Los Angeles 38, for details on drilling recorder.**

●

Steel filing cabinet for logs

...has been announced with five drawers that will hold a total of 2,500 average electric logs. The high capacity is achieved by use of two separate follow blocks in each drawer. Ball-bearing-equipped rollers and strong suspension arms allow the drawers to slide all the way out easily for complete accessibility. The E-25 cabinet occupies only 3½ sq. ft. of floor space. It comes in both gray and olive-green colors. Available for the cabinet are custom-designed filing supplies, folders, file envelopes, and guides. **Contact Manufacturer: Ross-Martin Co., P. O. Box 800, Tulsa 1, for details on E-25 electric-log file cabinet.**

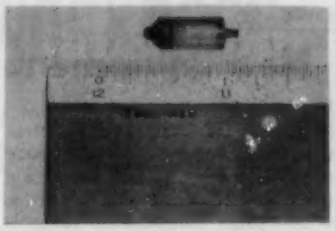
●



Portable geophysical instrument

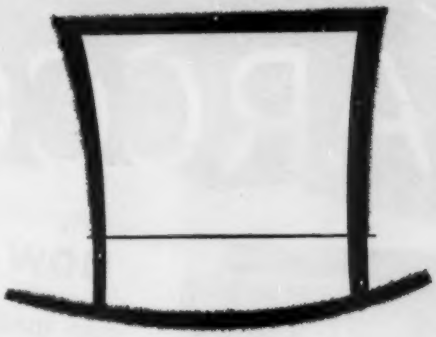
... that allows the production of fully corrected seismic records in the field and which provides extreme flexibility with respect to the types of ground spreads has been developed. Fast and precise, the unit is fully transistorized and weighs about 50 lb. The accompanying power and switching unit weighs about 45 lb.

The portable Geopac unit is designed in such a way that velocity information can be set so that it is not necessary to have cams cut. Sixteen ordinate points can be set to give the proper move out for any area. Any arrangement of the pickup points with respect to the shot hole is permissible. The tape used is 24½ in. long and 6½ in. wide. Another valuable feature of the instrument is that only simple printing equipment is needed to obtain complete record sections. **Contact Manufacturer: General Geophysical Co., Houston Club Building, Houston, for details on portable Geopac unit.**



Tiny pressure switch weighing ¼ oz.

... is now available to serve as a leak detector in both pressure and vacuum systems. About the size of a transistor, the switch is designed for surge, leak,



FIRST IN OIL IN THE OIL CAPITAL

Since the days of the beaver hat, First of Tulsa has served the oil industry in its activities the world over. Here's the experience and know-how . . . in both finance and oil . . . you want from your bank. Look to First National.

Think... 1st of Tulsa

THE FIRST NATIONAL BANK AND TRUST COMPANY

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

SHOWCASE . . .

New Equipment

and variance detection. It is especially adaptable to feed lines on control panels or any application where space is a premium. Its setting limits are 1 to 100 psig. Operating range is 1 to 500 psig. Temperature range is —65° to 250° F. Proof pressure is 3,000 psig. and burst pressure is 5,000 psig. **Contact Manufacturer: Century Electronics and Instruments, Inc., Box 6216, Tulsa, for details on leak-detector pressure switch.**

Packaged pipeline control system

. . . has been developed that is designed for any degree of compressor automation. It consists of three basic control panels. These range from a simple engine starting system to a fully automatic engine and compressor control for remote location. With the addition of a computer controller and telemetering equipment, any number of remote automatic panels can be tied together for the automation of a complete station or pipeline.

The Model SE control for sequenced

engine control is positioned adjacent to the compressor where it enables the operator to start or stop the engine with the push of a button. The Model SEC providing sequenced engine and compressor control combines all functions of engine and compressor control in one panel. Located at the compressor, it is designed to monitor and automatically control all operating phases from start to stop.

The Model SEC-R is a fully automatic control for remote location. It can be located at a central control point away from the individual compressor. This unit has facilities for tie-in to a computer controller or an entire pipeline control system. **Contact Manufacturer: Clark Bros. Co., Olean, N. Y., for details on packaged pipeline control systems.**

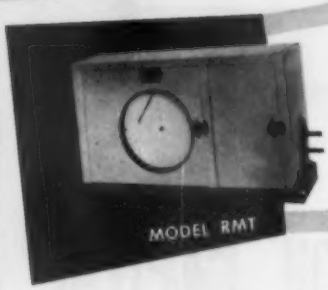
●

Pressure-sealing gate valve

. . . that provides a tight seal both up and downstream that requires no lubrication is being made available. It comes in ASA 150 and 300-lb. classes in sizes from 2 to 12 in. The valve has a full bore and through-conduit seats that automatically adjust for wear.

One unusual feature of the valve is the design of the floating seats. Each

ARCCO



NOW *specific* GRAVITY RECORDING OF LIQUIDS AT ANY DISTANCE

Accurate long-distance transmission of specific gravity recordings is no longer a problem with any of the new RMT Models of Arcco-Anubis Recording Gravitometers for recording and transmitting liquid gravity records. These instruments combine the mechanism of the standard Arcco Liquid Gravitometer with a metameter telemeter transmission system which records and transmits the specific gravity record to control room or other remote location. The inter-connecting line may be any two-wire electrical circuit or its equivalent: private wires, telephone circuits, carrier current channels, or radio (VHF or UHF). *Request Bulletin No. 111-R3.*

AD NO. 102

AMERICAN RECORDING CHART COMPANY

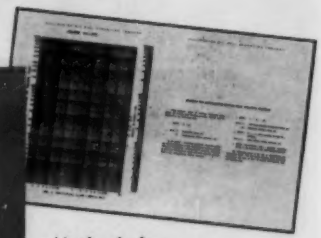
7142 East Condor Street, Los Angeles 22, California

Send for Bulletin 111R-3

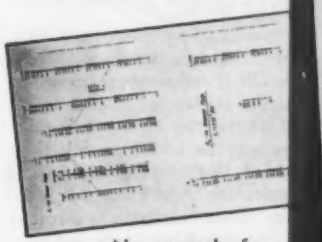
HERE'S THE FRACTURING WORKBOOK YOU'VE BEEN WAITING FOR!

A copy of this extremely current and valuable book is available on request. Be sure and ask for your copy today.

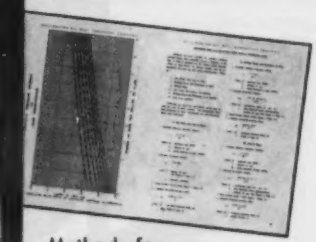
39 Pages of Important and Vital Data Regarding Fracturing.



Methods for Determining Bottom Hole Treating Pressure.



Nomographs for Calculating Fracturing Fluid Efficiencies.



Methods for Calculating Frictional Pressure Loss.

Area and Sand Quantify Calculations.

Determination of Horsepower Requirements.

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seat consists of two kinds of rubber molded to a hardened-steel insert ringed with holes. Soft rubber for sealing is applied to the back of each seat and tough abrasive-resistant rubber is applied on the front or gate side.

A neoprene-rubber bellows indicator, colored bright yellow for long-range visibility, extends above the handwheel when the valve is open. It retracts into the handwheel when the valve is closed. It also protects the stem threads from dirt and corrosion. The body and bonnet are cast steel, the stem is heat-treated hardened stainless steel, and the gate is made of hard-chromeplated steel. **Contact Manufacturer: W-K-M, Div. of ACF Industries, Inc., P. O. Box 2117, Houston 1, for details on double-action gate valve.**

●

New pumping unit

. . . is designed to take advantage of either single-cylinder engines or electric motors as a power source. It has an equal torque factor in either direction of rotation. The counterbalance effect has been increased without having to add to the counter-balance weight by increasing the height of the crankshaft above the ground level.

Called the Century Series, the pump has a positive lubrication system with remote fittings that can be serviced from ground level. Other features include wider cable spacing and more space for wellhead connections as compared to older types of units.

Capacities of the pumping unit range from 9,000 to 30,000 polished-rod load capacity. **Contact Manufacturer: Oil Well Supply Div., U. S. Steel Corp., P. O. Box 478, Dallas, for details on Century Series pumping units.**

●

Drilling testing tool developed

. . . recently promises to reduce down time as much as 95%. The CR (continuous retrievable) sampler allows the packer to be run above the bit so a formation may be tested at any time without the operator having to remove the pipe from the hole. Thus it can eliminate two round trips to install test tools and later remove them as required in conventional testing.

The sampler can recover several gallons of fluid, and, within an hour, drilling may be resumed. This is compared with the conventional methods for testing which require down time of 12 to 72 hours.

The sampler consists of two main assemblies. The tool body contains the packer and packer inflation valve. The sampler assembly consists of a fishing neck for sand-line removal, an optional number of retrievable sampler barrels, a pressure-operated sampler valve, and a pressure recorder. The sampler is operated hydraulically by pump pressure. No rotation or up-and-down movement is required. **Contact Manufacturer: Halliburton Oil Well Cementing Co., Duncan, Okla., for details on CR sampler.**

The growing use of platinum catalysts in reforming feed stock emphasizes the importance of pre-removing trace metals such as arsenic, lead and sulphur compounds. Platinum catalysts are poisoned by these substances in quantities even as small as ten parts per billion.

Treating the feed stock before the trouble occurs, Florex adsorbent provides the simplest, most economical means to protect expensive catalysts. Florex in the granular grades will completely remove or reduce these compounds to a harmless level.

Recognized throughout the world as superior to all other natural clays, Florex is prepared from carefully selected Florida Fuller's Earth by a special processing, including high pressure extrusion.

Meshes from 8/16 and up are customarily used. Write for information today.

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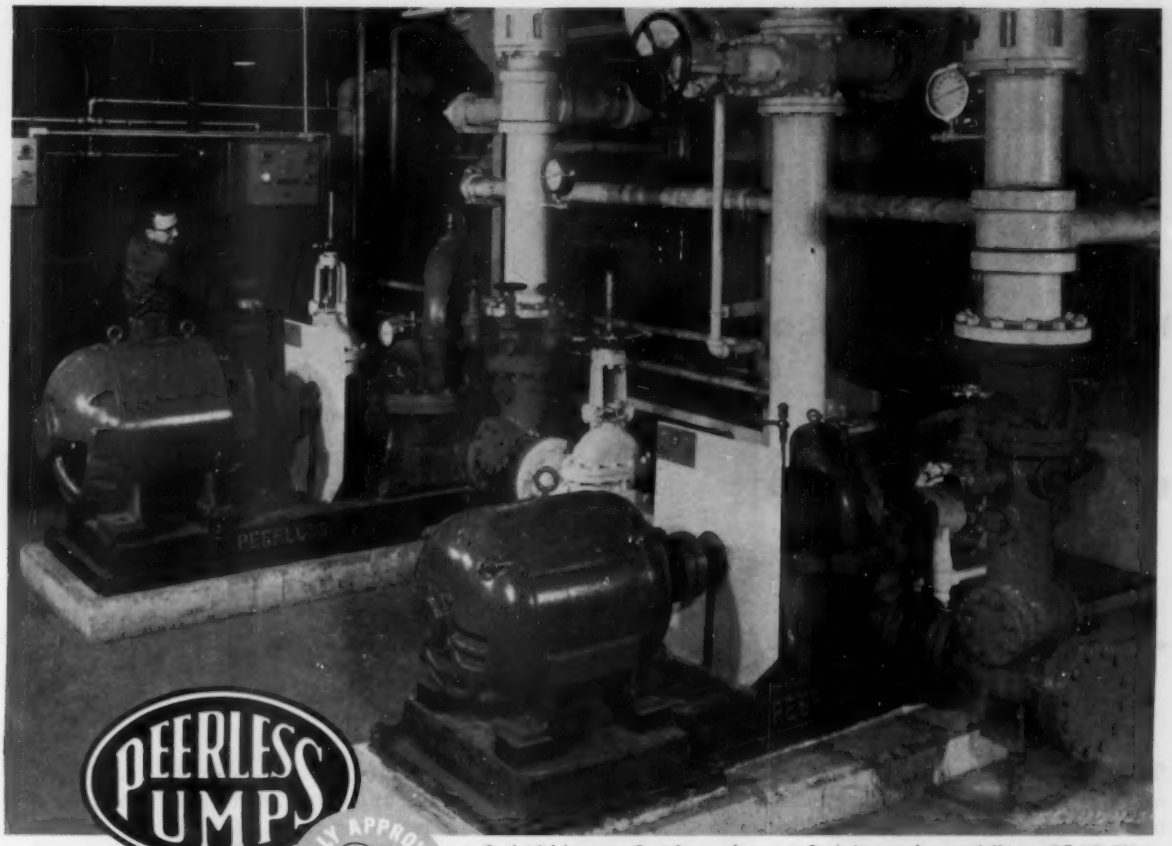
Dept. C P. O. Box 989 Tallahassee, Fla.



PEERLESS PUMPS

PEERLESS FULLY APPROVED FIRE PUMPS...

FULLY APPROVED UL FM

Prudential Insurance Co. takes no chances on fire in its recently erected Chicago Office Building. Peerless pumps give immediate protection against fire automatically, without human attention.

HOW TO DEAL WITH A FIRE BEFORE IT STARTS!

To insure adequate protection against the hazards of fire, a qualified independent fire protection system is a must. And to be doubly sure of the best system, the vital heart of the unit, the pump, should be the best money can buy. That's where Peerless *fully-approved* fire pumps excell.

Throughout a third of a century, Peerless fire pumps have attained an enviable and pre-eminent reputation in protecting all types of buildings, plants and warehouses. Put this know-how to work on your protection problem. See how Peerless' combination of top quality fire pump equipment, exacting engineering application and nationwide service can serve you best. In many instances, the savings effected thru more favorable insurance premiums can pay for the installation. For fire pumps at their very best look to the leader, look to Peerless. Write for bulletin B-1500 today.

Available with steam turbine, engine or electric motor drives, Peerless fire pumps are available for high pressure sprinkler systems, or foam smothering systems in every kind of commercial, or industrial installation.

fmc FOOD MACHINERY AND CHEMICAL CORPORATION

Putting Ideas to Work

Peerless Pump Division

Plants:
Los Angeles 31, Calif. and Indianapolis 8, Ind.

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FOOD MACHINERY & CHEMICAL CORPORATION
2005 NORTHWESTERN AVENUE, INDIANAPOLIS, INDIANA

Gentlemen: Please send me immediately a copy of your Bulletin B-1500.

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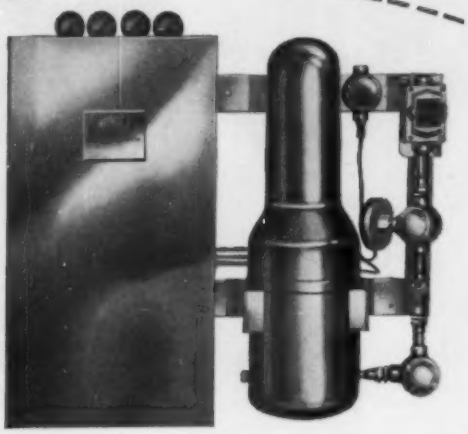
COMPANY_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____



FOR MAXIMUM YIELD

LOWER CONTROL COSTS.

THE NEW TOTCO *continuous* END-POINT ANALYZER

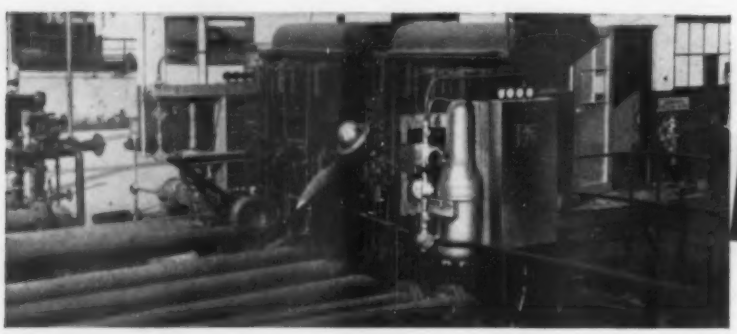
TOTCO's *continuous* End-Point Analyzer pays its own way in profits . . . by giving refinery operators a new and unique control over product quality and yield. This sensitive instrument is always on the job —right at the operating unit — for the *continuous* analysis of any petroleum product where the end boiling point is critical.

It automatically indicates the Engler End Point of a hydrocarbon stock or commodity in an operating range of 200°F. to 600°F.

The unit responds immediately to any variation in the end boiling point of the sample, and its *continuous* signal may be fed directly to a controller as well as to a recording chart. It delivers reproducibility within ±1°F., with results that correlate with ASTM D-158 or ASTM D-86.

Depend on this TOTCO Analyzer to reduce control costs by saving time. Its *continuous* analysis cuts the usual delays between quality change and compensating plant control...eliminates the time lag of batch analyzers or conventional laboratory tests.

Write or call today for further information.



TOTCO continuous End-Point Analyzer in operation at Union Oil Company Refinery, Wilmington, California.

GET FULL DETAILS NOW

Illustrated technical literature available free on request.

TOTCO

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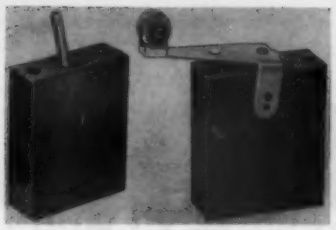
MANUFACTURERS OF PRECISION INSTRUMENTS SINCE 1929



Miniature valve with snap-action

. . . operator has been developed that has a number of potential applications. In pneumatic control systems it can be used for pilot operation of main valves, limit switches on pneumatic valves and other moving equipment, and automatic pressure, temperature, and level devices requiring snap-action tripping.

The valve's operating force is not affected by the operating pressure or flow rate. **Contact Manufacturer: Instruments, Inc., Box 556, Tulsa, for details on Micro valve.**

●

Needle valve for high pressure

. . . has been developed that uses a renewable glass-filled Teflon seat to obtain a tight shutoff for fluids at pressures from vacuum to 6,000 psi. The valve is made of AISI 303 stainless steel with Teflon O-rings.

The Dragon Model 816 valve can be panel-mounted in a few seconds. Just remove the handle and lock nut, then slip the valve into a predrilled hole in the panel and replace the lock nut and handle.

The valve has fine-pitch threads and a taper point that give excellent metering qualities. The valve can be completely overhauled without removing it from the line. The maker's standard ports are female National pipe threads or female tubing. **Contact Manufacturer: Dragon Engineering Co., Inc., P. O. Box 185, Norwalk, Calif., for details on Model 816 valve.**

NEW!

2½-lb. Pressurized Dry Chemical

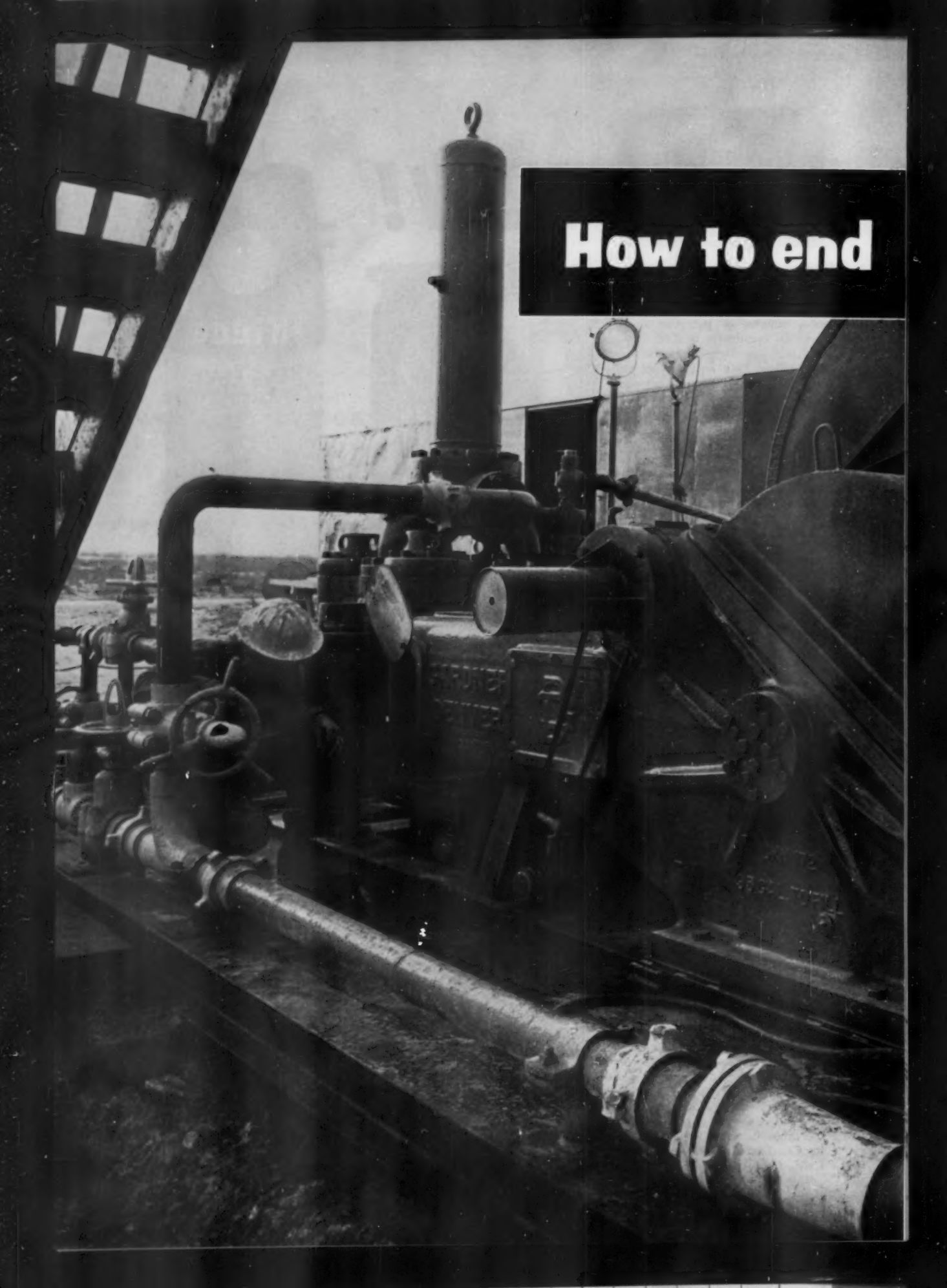
5-lb. Pressurized Dry Chemical

Kidde dry chemicals kill more fire faster!

Granted top rating by Underwriters' Laboratories, these two new Kidde dry chemical extinguishers pack the *extra* punch you need to knock out stubborn blazes. These 2½- and 5-pound Kidde units put out as much fire as eight and sixteen one quart carbon tetrachloride portables respectively. They are perfectly balanced for fast action, are light in weight, easy to operate even while wearing gloves. And — no pin to remove, no valves to turn, no inverting or bumping needed. Just aim at fire and press the lever! Pressurized, they can be easily and quickly recharged with air or nitrogen. No pressure cartridge needed. Write for more information on these new Kidde extinguishers — easiest-to-operate of all dry chemical portables.

Kidde

Walter Kidde & Company, Inc.
654 Main St., Bellevillo 9, N. J.
Walter Kidde & Company of Canada Ltd.
Montreal—Toronto—Vancouver


How to end

Mud-Pump Headaches

Gardner-Denver Mud Pumps have the power, the flexibility and the **dependability** to keep a well under control. They give you a real whip hand over formation pressures and circulation problems. Their reputation as **quality leaders** is unchallenged.

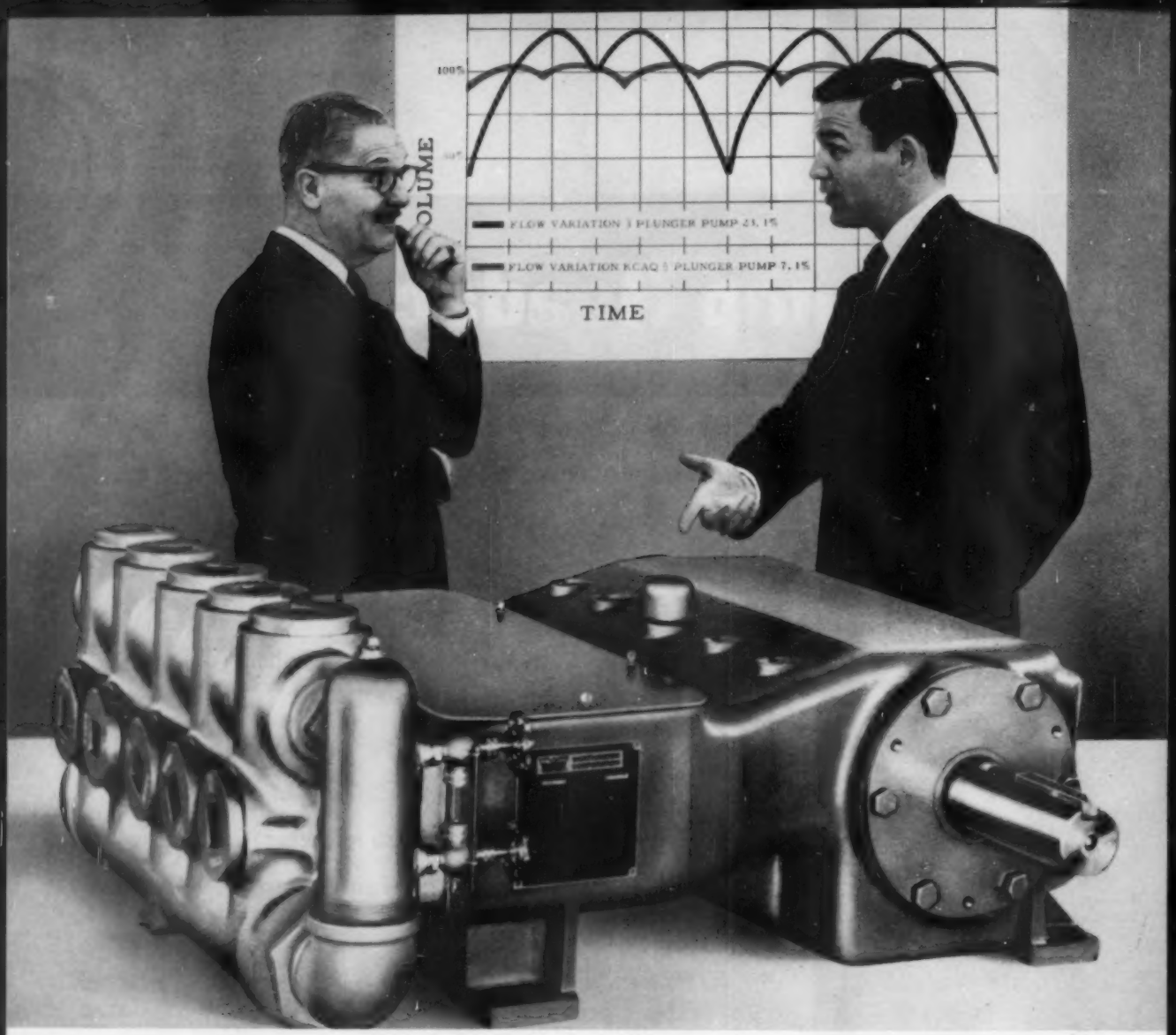
All parts replacements can be made in the field. The right- and left-hand cylinders in the famous **Gardner-Denver** fluid end are interchangeable. Pressure lubrication is provided in the power end. The packed oil stop head keeps oil in, mud out. One-piece connecting rods . . . no bolts to work loose. Parts are available through your nearby J&L Supply store.

Five GX models, 350, 500, 700, 1000 and 1250 h.p. Ask your local J&L Supply man for illustrated **Gardner-Denver** literature or write us at Tulsa—Drawer 2481.

Jones & Laughlin

SUPPLY DIVISION – Tulsa

If it's sold by J&L . . . .
It's the best available



NOW! A 5 PLUNGER WATERFLOOD PUMP

for less than competitive 3 plunger models

You're looking at Worthington's new KCAQ Quintuplex waterflood pump.

This new 5 plunger 3 inch pump will deliver the horse power of competitive 3 plunger 4 inch pumps—yet sells for less money. And as the chart above shows, the KCAQ is a much smoother pump, delivering its volume with 70% less surge.

THE KCAQ HAS 6 OUTSTANDING FEATURES:

1. **Meets wide range of conditions.** Plunger diameters can be varied from 1¼ to 2½ inches.
2. **Fewer Spares to carry**—wearing parts interchangeable with 3 plunger KCA pump.
3. **Many "extras" included as standard** such as solid ceramic or Colmonoy plungers, suction air chamber to minimize noise and pulsation, plunger packing and stuffing box cover.
4. **Flooded suction adequate** because large pipe connections minimize friction. 4" suction, 3" discharge on either side.
5. **Less valve wear** resulting from guided, wing-type valves that are self-grinding. Liberally-sized suction and discharge valves both removable through single top covers.
6. **No shaft deflection problems.** Extra heavy crankshaft has 3 *roller* bearings.

Before you buy any waterflood pumps, investigate Worthington's new low cost KCAQ unit. Your nearby Worthington representative has complete information. Or write to Worthington Corporation, Section 32-5, Harrison, New Jersey. In Canada: Worthington (Canada) Ltd., Brantford, Ontario.

WORTHINGTON

SHOWCASE . . .

New Literature

Gas-chromatograph ionization-detection

. . . systems are outlined in a new 30-page catalog, free upon request. The literature lists features, sensitivity ratings, dimensions, accessories, and advantages of the instruments. It includes a photograph and a full-page block diagram of a particular model. **Contact Manufacturer: Wheelco Instruments Div., Barber-Colman Co., 1300 Rock, Rockford, Ill., for Gas-Chromatograph Ionization-Detection Systems catalog.**

New computing galvanometer

. . . designed to perform addition, multiplication, and subtraction, permitting calculation of power factor, average power, and other multivariable problems from a single moving trace, is detailed in Bulletin 1605A. The four-page literature illustrates with drawings the basic theory, application, and specifications of the Type 7-370 galvanometer. **Contact Manufacturer: Consolidated Electrodynamics Corp., 360 Sierra Madre Villa, Pasadena, Calif., for Bulletin 1605A.**

Cable tools for drilling

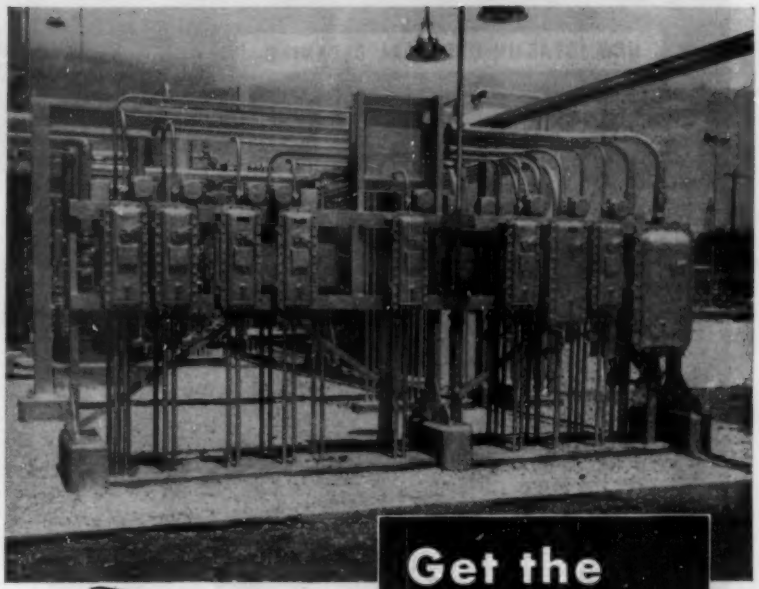
. . . are discussed in a new obtainable catalog. It features all regular drilling, fishing, and casing tools plus many specialties such as casing wagons, underreamers, and tool braces. **Contact Manufacturer: Rampp Co., 111 Third Street, Marietta, Ohio, for Cable Tools for Drilling catalog.**

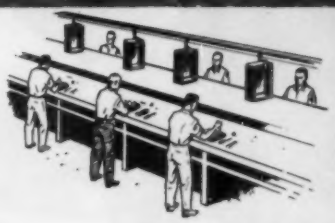
Aviation-fuel filter-water separators

. . . for refinery applications are described in two-page Data Engineering Sheet 103. Cross-section drawings and photographs illustrate two typical 300 and 600-g.p.m. models. **Contact Manufacturer: Filter Div., Bendix Aviation Corp., 434 West 12-Mile Road, Madison Heights, Mich., for Engineering Data Sheet 103.**

California-Operations brochure

. . . describes the personnel and equipment of a drilling company's California division. It's illustrated with photographs and drawings. Rig layout sheets and complete specifications of equipment of each rig will be in-





Get the economies of factory assembly

. . . plus satisfaction of field personnel by using Nelson Switchracks

Centralized motor control is the modern trend. In the above photo you see a Nelson switchrack with various components including control switches to motors driving the processing pumps in a fractionating plant of Warren Petroleum Corporation.

For outdoor installations Nelson switchracks provide ease of installation and all the advantages of factory assembly and wiring. One purchase order, one receiving report, yet you receive a complete unit. At Nelson each switchrack is specially designed to give the customer the ultimate in performance.

Nelson switchracks are available in either single front or double front, and with or without canopies for weather protection. Components can either be explosion-proof (NEMA 7), watertight and dust-tight (NEMA 4 & 5) or oil immersed (NEMA 8). If you have no preference for arrangement Nelson engineers will design to give you maximum utility in minimum space.

For more complete information write for Bulletin 497

At Nelson . . . *quality* comes first!

NELSON *Electric* MANUFACTURING CO.
TULSA, OKLAHOMA

Citric Acid -- Dowell's New Service for Cleaning Stainless Steel Process Equipment

Now, for the first time, plant operators can be sure of a new degree of safety in the cleaning of their pressure units containing austenitic stainless steel—for example, heat exchangers, stainless-clad pressure vessels, atomic reactors, and supercritical-pressure steam generators. Citric Acid service by Dowell provides a new, effective method for these special chemical cleaning situations.

The Citric Acid used in Dowell chemical cleaning is inhibited with an *exclusive chloride-free* inhibitor. Cleaning with this new field-proven solution assures a chloride-free solvent system, and thus helps prevent chloride stress-corrosion cracking.

Dowell Citric Acid also provides other significant advantages: Citric Acid stabilizes dissolved iron and helps prevent precipitation of insoluble iron compounds when neutralizing chemicals are used. Flushing of the unit is not as difficult when Citric Acid is used. Citric Acid is especially suitable where stainless steel and other metals are used together in construction of the unit.

Citric Acid cleaning with a chloride-free inhibitor is just one of the new ideas from Dowell research. Other recent contributions include the new "white glove" standards of cleanness, copper removal agents and the new jetting device for cleaning heat exchanger tube bundles.

Ask your Dowell representative about Citric Acid service and Dowell chemical cleaning programs for your plant equipment. Dowell, the leader in chemical cleaning service and research, operates in every major industrial area through 165 offices and stations. Dowell, Tulsa 1, Oklahoma.

Chemical cleaning service for all industry DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY

cluded with your request for the literature. **Contact Manufacturer: Brown Drilling Co., 1456 East Hill Street, Long Beach 7, Calif., for California-Operations brochure.**

Meters for measuring liquid levels

. . . and tank contents are outlined in a new eight-page publication. Bulletin 945 presents text and pictures of the new Tank-O-Meter, an instrument which measures from any remote distance.

The literature contains applications, accuracy information, installation methods, line drawings, and characteristics and dimensional charts. **Contact Manufacturer: Uehling Instrument Co., 498 Getty Avenue, Paterson 3, N.J., for Bulletin 945.**

Capacitors for electrified pumping

. . . and their application to oil-field systems to improve motor operation and reduce line current and losses, are described in four-page Bulletin GEA-6625.

The publication includes charts of capacitor operation, motor performance, and circuit connections; tables of recommended ratings for various motor types; savings for typical installations; ratings, weights, and dimensions. **Contact Manufacturer: General Electric Co., Schenectady 5, N.Y., for Bulletin GEA-6625.**

Bulletin describes tubing joints

. . . which feature positive-sealing Teflon-ring seals and mechanical metal-to-metal threads seals. Originally designed for use on P-105 and higher-grade tubing, the Dual-Seal connection is also available for use in wells of all depths and conditions, according to Bulletin DS-59.

The 16-page publication also contains information on how to calculate running clearance in casing. **Contact Manufacturer: Hardy-Griffin Engineering Corp., 14522 South Main Street, Houston 25, for Bulletin DS-59.**

Centralized-lubrication report

. . . discusses the application of modern centralized lubrication to reduce industrial operating costs and improve production.

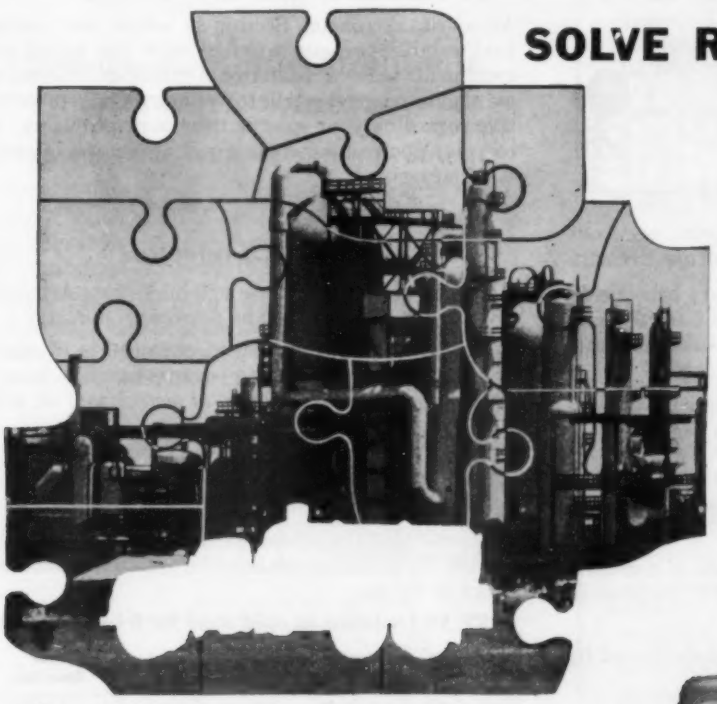
The 16-page brochure (1) explains the role of centralized lubrication and its advantages over manual methods of greasing and oiling industrial machinery; (2) gives three economic areas of plant management where it might effect substantial savings; (3) outlines five steps for converting to automatic lubrication; (4) gives case histories of uses in all major industries; and (5) includes detailed application data on basic centralized systems. **Contact Manufacturer: Industrial Div., Lincoln Engineering Co., 4010 Goodfellow Boulevard, St. Louis 20, for A Report to Management brochure.**

Cutting-tool reference data

. . . is given in an illustrated, pocket-size, 48-page booklet. It describes the manufacturer's line of spiral bits, taps, reamers, and milling cutters. The booklet also contains a number of useful tables, including one for converting fractions of an inch to millimeters. **Contact Manufacturer: English Steel Tool Corp., Ltd., River Don Works, Sheffield 9, England, for cutting tool reference.**

Automatic-valve wall chart

. . . features ready reference data on heating controls, relief valves, pressure regulators, and safety devices. The two-color chart measures 12 by 18 in. **Contact Manufacturer: A. W. Cash Valve Mfg. Corp., P.O. Box 191, Decatur, Ill., for Wall Chart 59.**



SOLVE REFINERY PUZZLE

Fast!

A Thompson Unitized Vacuum Tank is the answer! Nothing can take its place for speedy cleaning of tanks, drain boxes, cooling tower basins, and spills.

There's no faster way to move liquids or semi-solids than with vacuum. Pick-up is fast, and reverse pressure built up while "on the road" makes discharge even faster. And, unlike old-fashioned pump tanks, the load doesn't pass through the pump!

Standard sizes from 20 to 100 bbls; and units are skid, truck, semi or trailer mounted. Write today for illustrated folder, and a new booklet on Refinery Safety.

This Cost-Cutting Tool

COMPLETES THE PICTURE!

THOMPSON TANK & MFG. CO., Inc.
2019 East Wardlow Rd., Long Beach 7, Calif.

SOLE LICENSEE TO MANUFACTURE VACUUM TANKS UNDER U. S. PATENT NO. 2522077.

A look at today . . . and a glimpse

Armour Chemicals for oil production

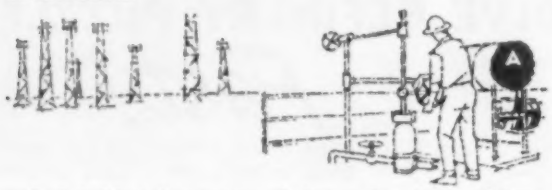
Where they work today

For many years, Armour aliphatic organic chemicals have solved numerous problems in the production of petroleum. That's why you'll find them at work where injection waters are being treated, when HCl is being inhibited, or where water coning problems are being studied.

Treating injection waters

Today there is ever-increasing evidence that shows corrosion inhibitors *alone* are not enough to control corrosion in water flood operations effectively.

A variety of field applications confirm the theory that bactericides are needed, too. In fact, there are many indications of a direct correlation between the presence of sulfate-reducing bacteria and the degree of corrosion.



In brief, here's some new information obtained from a report presented at an A.P.I. committee meeting.

(*a*) By injecting only small quantities of a bactericide into a system known to contain sulfate-reducing bacteria, 80% protection against corrosion was obtained. No other inhibitor was used.

(*b*) Most sulfate-reducing bacteria are known to multiply at an accelerated rate when temperatures increase. Actual tests show bacteria multiply 10 times faster at 95°F than at 77°F. As a result, when temperatures increase, bacteria increase—and so does the rate of corrosion.

In fact, the report shows the rate of corrosion jumps about 100 times with 130°F increase in temperature.

The above information was further substantiated by field tests.

In a cooperative test on an East Texas flood, one of Armour's organic chemicals—a combination inhibitor/bactericide—reduced the corrosion from 68 MPY to 1 MPY.

At the same time, all sulfate-reducing bacteria were brought completely under control.

And this protection was accomplished at a cost of less than 1 mil per barrel of injected water!

Here is what Armour recommended as a treatment procedure for "seasoning" a typical system.

- Slug the system with 40-50 ppm bactericide/inhibitor (basis: fluid injected) for about 3 days.
- Cut back the concentration to 25 ppm for 7 days.
- Further reduce the concentration to about 10 to 15 ppm after a bacterial analysis has verified complete control of bacteria and effective reduction in the rate of corrosion.
- Continue periodic sampling and analysis to assure the treatment continues to be effective.

Armour's Petroleum Section is aware that certain field conditions may interfere with the initial slug treatment with a bactericide/inhibitor. Therefore, we suggest that you talk to your Armour representative regarding your specific treatment problems. He can give you recommendations for your special water flood situation.

Check "A" in the coupon for complete information.

New HCl Inhibitor

Armour's new hydrochloric acid inhibitor—Armohib® 28—is now available to the petroleum industry.

This fatty-nitrogen-derived chemical is of special value when HCl is used to remove harmful deposits or scale during the fracturing or acidizing of oil wells.

As little as 0.25% of Armohib 28 enables you to use a 10-15% HCl solution and get 99.8% protection against pitting and corrosion. The cost? Only $0.0125 per gallon of acid.

In addition, this new inhibitor is completely safe to use. It produces no harmful side effects to reservoirs or fluids.

15% HCl solution on mild steel for 6 hours at 200°F

% Armohib 28	Corrosion Rate lbs/ft²/day	% Protection	Cost per Gallon of Acid	Visual Appearance
(Control)	7.9	—	—	Disappeared in 4 hours
0.10	0.0310	99.6	$0.005	Bright, No Pitting
0.15	0.0260	99.7	0.007	Bright, No Pitting
0.25	0.0190	99.8	0.012	Bright, No Pitting

# of tomorrow

from Armour Chemical

Further testing of Armohib 28 at 265°F has also produced excellent corrosion protection on mild steel.

Here are some additional advantages of Armohib 28:

- It effectively controls corrosion of 316 stainless steel, monel, bronze and mild steel.
- It is effective over a wide temperature range.
- It's non-staining. Will not deposit a waxy surface film on treated metal; leaves the surface clean and bright.
- It will not precipitate in the presence of ferric ions.

For more protection against HCl corrosion at less cost, put Armohib 28 to work in your acid treatments.

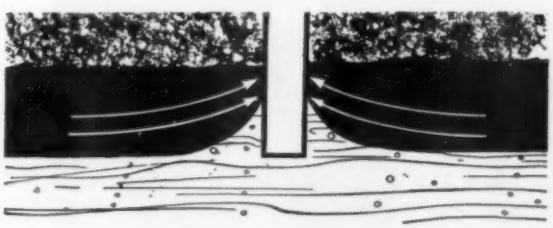
For more data, check "B" in coupon.

Where Armour Chemicals will work tomorrow

Solving the Water Coning problem

Laboratory data and field tests indicate that certain Armour water-soluble cationic chemicals—when introduced into the coned area of a producing well—will considerably reduce the water/oil ratio.

These findings were recently substantiated in a test on one well of a two-well field producing into a common tank battery. During the test, *oil production* was increased from 200 to 390 barrels per month!



The treatment consisted of solubilizing 40 to 50 gallons of the proper Armour surfactant in a 210-barrel tank of produced water. The water was then slowly pumped into the well to be treated, followed by a quantity of untreated water to displace all the treated fluid from the annulus into the cone.

This approach is based on work done by Dr. Alan S. Michaels of M. I. T.

Admittedly, additional research and field tests are needed. Armour Chemical is continuing more test programs in cooperation with several producers.

Check "C" in coupon for more complete information.

If you have problems in oil production, contact Armour. As the leading producer of organic chemical corrosion inhibitors/bactericides, we are qualified to help you determine the right chemical for your special situation. Send the coupon. Or better yet—call us today!

NEWS NOTES

Washington, D. C. Patent #2,733,206 recently issued to Armour and Company covers water flood treatment with dicoco dimethyl ammonium chlorides, or with compounds containing this chemical. Included in the patent claims are inhibition of bacteria, prevention of corrosion, and decreasing of interfacial tension between oil and water phases.

Kansas. Cost figures from a water injection system in this state, just released, show an Armour corrosion inihibitor/bactericide saved the operator almost $66,000.00. Total cost of the chemical was only $2,500!

Illinois Basin. 2½ gallons of an Armour Chemical recently increased the water intake of an injection well here from 19 to 35 barrels of water per day. After 3 weeks, with no further treatment, the well still was able to take 31 BWPD!

Texas. During a recent field test, one of Armour's polar organic compounds proved to be the only product to foam oil effectively. It is believed this chemical will prove to be very valuable in wet-gas wells which have built up a liquid head great enough to kill the well.

Leader in Progressive Fatty Acid Chemistry

ARMOUR CHEMICAL DIVISION

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Armour Chemicals can save you money

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Send samples and more information for this application:

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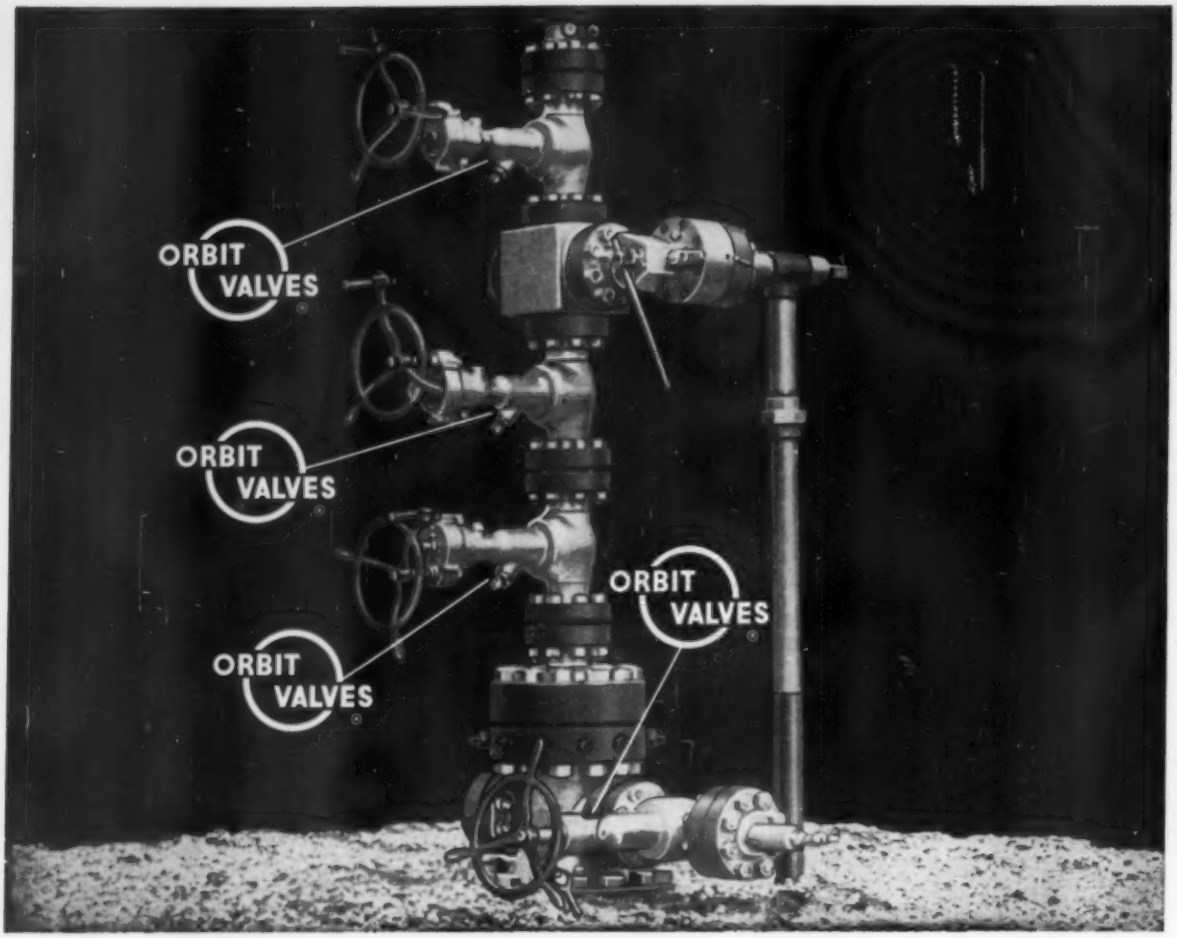
Armour Chemical Division · 3155 W. 31st St. · Chicago 9, Ill.



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ORBIT VALVES have a well established reputation based on actual performance that provides positive seating without lubrication; easy operation, and long years of service with low cost maintenance. ORBIT VALVES have the kind of QUALITY that pays off on the job.

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Write for Catalog 58-A covering Orbit Valves for Christmas Trees and general production use.

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WAREHOUSES: HOUSTON, TEXAS, 407 Velasco, CApitol 8-6623, TWX HO 115; ODESSA, TEXAS, 402 West County Road, FEderal 7-2253, TWX ODESSA TEX 8706; LAFAYETTE, LOUISIANA, 3111 Cameron St., CEnter 4-3326; CASPER, WYOMING, 414 South Elm Street, Phone 2-1324; EDMONTON, ALBERTA, CANADA, 7119-104th St., Phone 391-283. WEST COAST REPRESENTATIVES: Charles Lowe Company, 383 Fourth Street, San Francisco, Calif.; Marshall E. Neidecker Company, 2785 Cherry Ave., Signal Hill, Calif. CANADIAN REPRESENTATIVES: T. R. Pickford & Company, Ltd., Calgary, Alberta, 309 7th Avenue West; Amherst 2-7371. EXPORT REPRESENTATIVE: New York 36, N. Y., 500 Fifth Avenue, BRyant 9-2236.

George F. Burley reappointed

. . . vice president, sales, of Crane Co., according to L. H. T. Clegg, acting president of Crane. Burley joined the company as vice president in December, 1957.

Meanwhile four other major sales appointments were announced. These include: Clarence E. Watson, general manager of atomic-energy sales; Darrell R. Nordwall, general manager of branch sales; Charles H. Lovelace, general manager of engineering sales; and R. W. Lindsay, general manager of wholesaler sales.

Harold Schneider to manage

. . . Tuboscope Co.'s quality-control department where he will supervise training of personnel in field-operating procedures and will serve as technical advisor to the Houston company's sales department.

Schneider will also manage the firm's safety and fleet programs and will serve as liaison representative to manufacturers who produce Tuboscope special products.

Southern Engine & Pump Co. gets

. . . Gulf Coast sales and service representation for Frank Wheatley Corp.'s pistons and plunger pumps. The report comes from Huber Dye, executive vice president of Wheatley, and S. R. Carrington, president of Southern Engine & Pump.

The Houston company will offer exclusive Frank Wheatley sales and service representation from New Orleans, Corpus Christi, and San Antonio. In addition, the Wheatley pump line will be sold from offices in Beaumont, Edinburg, and Lafayette.

Dye announced that Bob White, previously with Wheatley's Houston office, will join Southern Engine & Pump to expedite that company's orientation of Wheatley products.

Allen Oil Tool Co. to represent H. C. Smith Oil Tool Co.

. . . throughout Alaska, according to Arthur S. Marshall, vice president in charge of sales. Headquarters (shown above) are located in Seward, and principals are Kenneth and Chester Allen. The Alaskan company is represented in southern California by L. G. Robinson of Venice, Calif. The new representatives are under the direction of H. C. Smith Oil Tool's own staff representative, James E. Sayers, who locates in Edmonton, Alta.

Newly named company reports

. . . staff additions. Frank Wheatley Corp.—formerly Frank Wheatley Supply, a subsidiary of Frank Wheatley Pump & Valve Mfgr.—has acquired the services of A. R. (Blondie) Parker to serve the Mid-Continent and Gulf Coast area with the firm's combination plug and check valves.

Other changes include the advancement of Gus Baker, Jr. to executive vice president of the parent company; Hubert Dye, parent company vice president; and William Gray, special advisor to the manager.

New industrial group to provide

. . . a diverse range of equipment and services for Edmonton, Alta., and western Canada in oil and industrial

E. W. Disler

J. H. Milner

fields. The newly integrated group of five companies is headed by Canadian Diamond Steel Industries, Ltd., with headquarters in Edmonton.

Heading the list of officers of the parent company are E. W. Disler, executive vice president, and Jarvis H. Milner, vice president in charge of operations.

Disler was with Union Oil and the Dresser Industries in California and various parts of the United States before moving to Canada in 1951 to join Pacific Pumps, one of the Dresser Industries.

Milner was area manager for Johnston Testers before being appointed president and general manager of Canadian Diamond Coring, Ltd., a position he held for the last 6 years.

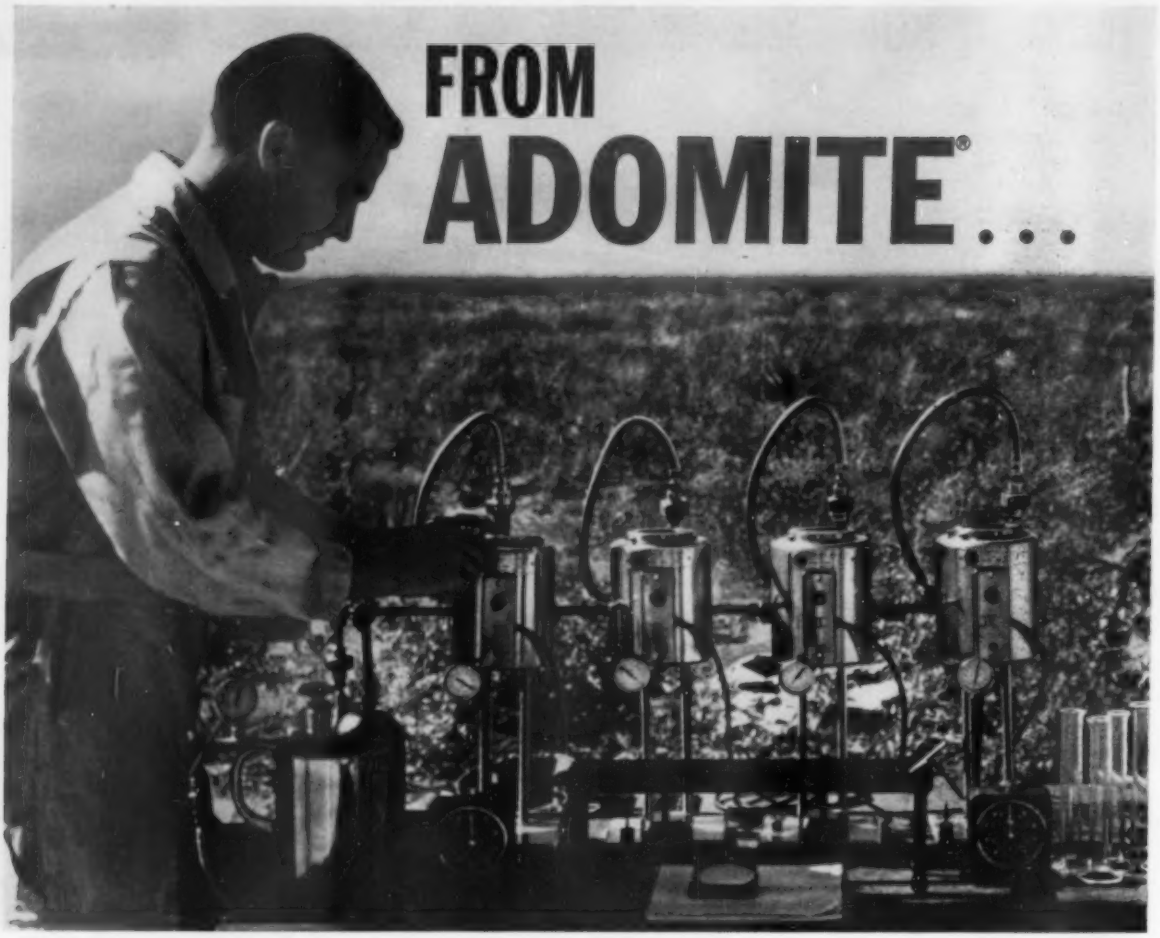
Welex, Inc. personnel graduate from log-interpretation school

. . . at the Welex research and development labratory in Houston. Left to right, front row, are R. Coleman, instructor, Houston; O. S. Harbison, Great Bend, Kans.; P. R. McFall, Lafayette, La.; J. E. Wilson, Houma, La.; Davis Owens, McPherson, Kans.; and B. Smith, instructor, Houston. In the back row are J. D. Widders, Kimball, Neb.; Gerald Lindsey, Ardmore, Okla.; J. D. Young, Artesia, N. M.; J. L. Brown, Hays, Kans.; Ray Marshall, Houston; and R. M. Winters, Andrews, Tex.

J&L Supply transfers six

. . . salesmen to different stores or sales offices, and promotes two men to salesmen at their present locations, reports W. L. Wolfe, vice president, sales.

R. J. Bevington has been transferred to McAllen, Tex. from Freer,



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ADOMITE, famous for fluid-loss control, offers producers a special testing service to provide technical assistance and important data on fracturing fluids. Each ADOMITE representative is equipped to run high-pressure, controlled temperature fluid-loss tests at no cost to you.

The job of the ADOMITE man is to provide the best possible fluid-loss control in fracturing fluids. This assures you of the greatest possible fracture extension at the most economical cost.

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CEntral 2-1371

Joe M. Foster
Wichita Falls, Texas
Phone 723-8181

H. L. Thomason
Casper, Wyoming
Phone 3-3721

Goss Yeager
Lubbock, Texas
POrter 3-9271
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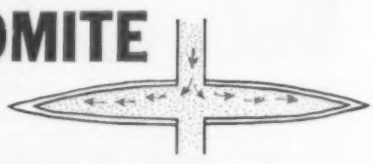


...fluid-loss additive

Tex. R. D. Landis goes from Alice, Tex. to Freer. C. L. Wallace leaves Houma, La. for Brookhaven, Miss.

B. W. Ramsey goes from Lake Charles, La. to Houma; H. E. Reeves, from Brookhaven to Natchez, Miss.; and D. R. McKown, from Williston, N. D. to Houston.

P. A. Toomey, storeman at Williston, and T. D. Gholson, a graduate of J&L's sales-training program, will take over as salesmen at Williston and Houston.

Baroid announces five new . . . appointments. The division of National Lead Co. has named B. L. Boccella assistant manager of operations at the Houston general offices. Boccella, former manager of Baroid's Mid-Continent area at Tulsa, has been with the division since January, 1941.

B. L. Boccella

K. S. Lewis

Replacing Boccella at the Mid-Continent area is Kemp S. Lewis, former assistant manager in the lower Texas Gulf Coast area with offices in Corpus Christi. He has been with Baroid since 1937.

G. G. Allen

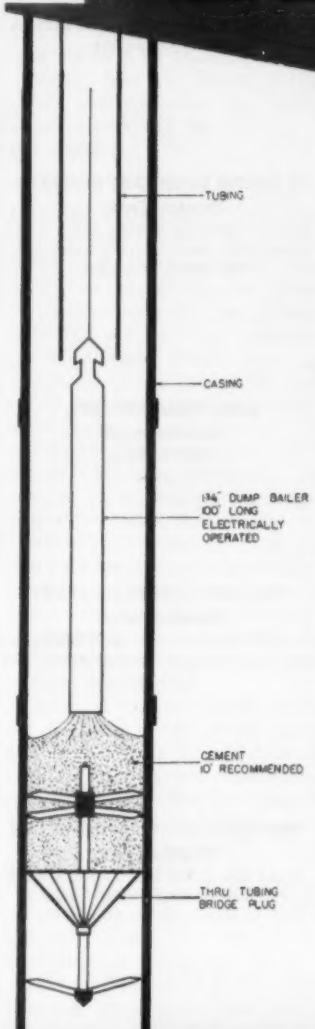
J. M. Bugbee, Jr.

R. K. Epps, Jr. has been appointed assistant chief drilling-mud engineer with headquarters in the Houston offices. His prior positions were sales-development engineer and area engineer for the lower Texas Gulf Coast area. Epps has been with the division 8 years.

G. G. Allen, previously district superintendent in the Louisiana Gulf Coast area, has been named assistant manager of the lower Texas Gulf Coast area and will headquarter in Corpus Christi. Allen came to Baroid in 1948. He earlier served as engineer in the Texas Gulf Coast.

J. M. Bugbee, Jr. has been appointed assistant manager of the lower Texas Gulf Coast area with head-

Cut Re-completion Costs in ½ with GO Thru-Tubing Bridge Plug and GO Perforating Service



Run through 2" tubing on a conventional perforating line, the GO Thru-Tubing Bridge Plug can be set at the exact point desired in 5½ or 7" casing. No tubing extensions required . . . no need to pull tubing . . . cement is dumped on plug with a thru-tubing dump bailer. Only requirement is that the well be in a static condition at the time plug is set. As a further advantage, use of the GO portable mast eliminates need for a service unit or rig over the well.

Typical Example of Savings Possible:

A GO Thru-Tubing Bridge Plug was set through 2" tubing in 5½" casing at 10,050 feet for a major oil company on the Gulf Coast. 24 hours after running cement, new zone was perforated with 32 shots. Total cost of complete job: $844.32. Operator estimated that the same job would have cost at least twice this amount using conventional re-completion method under the most ideal conditions.

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Fort Worth, Texas
Phone AX 3-1300

For superior service, call your nearest GO Oil Well field station

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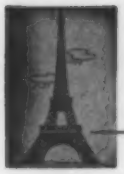

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Stand lifts, holds, tilts 55 gal. barrels Prevents spillage—easily loaded.

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XL Steel Pipe Couplings for OIL COUNTRY TUBULAR PRODUCTS.

MUD CONTROL MEANS MONEY

Oil well drilling mud must be properly controlled for protection and profit. That's why these three pieces of Cameron equipment have proven so popular in successful drilling operations all over the world.

"FLEX-SEAL" MUD LINE VALVES have been a standard of the drilling industry for twenty years. Their rugged dependability, low maintenance, and economical repair have placed them on almost every drilling rig.

"SHEAR-RELIEF" VALVES shear a common nail (U. S. Standard) to relieve destructive pressure overloads. Slush pumps, manifolds, and other expensive components are instantly protected by these unusual safety valves when desired pressures are exceeded.

CAMERON PRESSURE GAUGES have met wide acceptance for mud line service because their self-contained dampening mechanisms require no adjustment for changes in pressure range.

All three of these products were designed to work together and to do a better job of controlling vital but hazardous mud under high pulsating pressure. When you drill for oil or gas, COUNT ON CAMERON mud line products for protection and profits.

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mine UNDERGROUND STORAGE FOR LPG
ENGINEERS . . . . CONTRACTORS
FENIX & SCISSON, INC.
5805 E. 15th • TULSA 12, OKLAHOMA

quarters in Houston. He started to work for Baroid 12 years ago and has served as well logger, drilling-mud engineer, district sales representative in the Mid-Continent area, and marine superintendent at New Orleans.

Kenneth F. Williamson is named

K. F. Wiliamson

. . . assistant sales manager of Grove Valve & Regulator Co., reports George E. Doty, Grove's vice president and general sales manager. Williamson will locate in Oakland, Calif.

Prior to joining Grove, Wiliamson was sales coordinator for W-K-M Division of ACF Industries, Inc. He served in various other manufacturing and marketing capacities during his 16 years with the company.

Process Operators, Inc. formed

. . . at 2635 South Main Street in Houston, to serve engineers, constructors, and proprietors of refineries, petrochemical, and chemical plants all over the world. The company will provide industry with a large staff of operating specialists which has not in the past been readily obtainable on short notice.

Process Operators, Inc. can completely staff large processing installations or fill in existing operating staffs with even one specialist.

The firm is available for start-up and performance test runs on any type of new process plant, emergencies arising from personnel shortages, or continuous contract operation. Service on a moment's notice may be for long or short duration.

Some of the recognized advantages of the service are direct monetary savings to clients through best advantage use of equipment, economical arrangement of operation, elimination of organizational problems, and instructive training periods for inexperienced personnel.

The new firm was conceived and organized by J. R. Dudley and A. I. O'Keeffe. Dudley has had 20 years' experience in operating phases of refineries and chemical plants including start-ups, performance test runs, and emergencies. O'Keeffe has had over 20 years' experience in engineering, plant construction, process design, operation, and management with major engineering and construction firms.

Other members of the staff have completed many world-wide assignments and are well versed in all phases

wherever "dead men" are needed specify
Grip-Tite
POSITIVE EXPANDING ANCHORS

Grip-Tite is the *only positive* expanding anchor! Has fail-safe construction, positive lock-open expansion, made of long lived certified malleable iron—and all rods have 3" I.D. Eye! *There's a reason why Grip-Tite has had over 30 years superior performance in oil field use.*
USE FOR portable drilling mast, well servicing mast, pulling truck, floor blocks, derrick guy wires.

Come To Us With Your Anchoring Problems

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The PERFECT SEAL ROTATES WITH THE SHAFT
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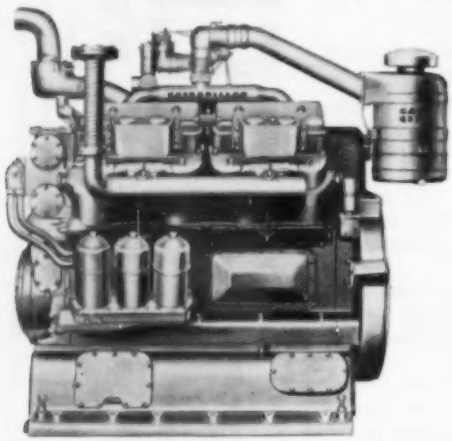
For Free Engineering Counsel on Your Sealing Problems, write DURAMETALLIC CORP., Kalamazoo, Michigan

engine power
BY CATERPILLAR

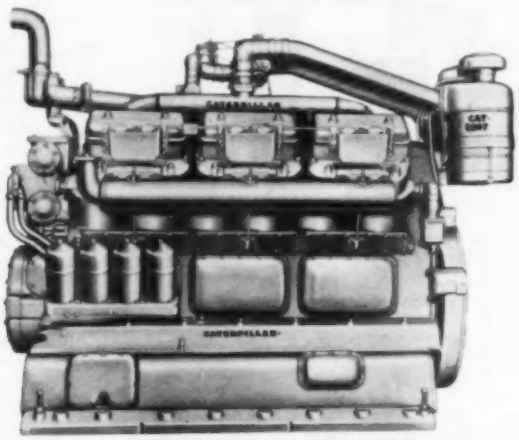
Higher horsepower ratings provide greater efficiency for oil men at no increase in cost

Although horsepower ratings for Caterpillar G375 and G397 Natural Gas Oilfield Engines are up, the purchase price remains the same. Along with more for the same money, you get all the traditional Caterpillar features—like low-tension ignition system. Safe and dependable, this system provides a hotter, more positive spark in the cylinders of all Cat Natural Gas Engines.

You can choose between two compression ratios. For operation on butane, propane or field gases, there is the 7.5:1 compression ratio. The 10:1 ratio—highest in the industry—is for operation with any methane-type gas. Of course, you can convert both engines to diesel from gas or vice versa simply by changing pistons and fuel systems. See your Caterpillar Dealer for complete new specifications—and to learn how they benefit your operation. Also, remember to specify Caterpillar for your oilfield equipment.



Rating for the G375 Natural Gas Engines, for continuous operation at 1300 RPM, without fan, now is 275 HP for 7.5:1 compression ratio. With the 10:1 ratio, it is 310 HP. New ratings for the G375 Natural Gas Electric Set with 10:1 compression ratio engine are 175 KW without fan, 160 KW with fan.



New ratings for the G397 Natural Gas Engines operating continuously at 1300 RPM without fan are 415 HP with 7.5:1 compression ratio and 470 HP with 10:1 ratio. New output for G397 Natural Gas Electric Set, with 10:1 compression is 275 KW without fan or 250 KW with fan.

CATERPILLAR

Engine Division, Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

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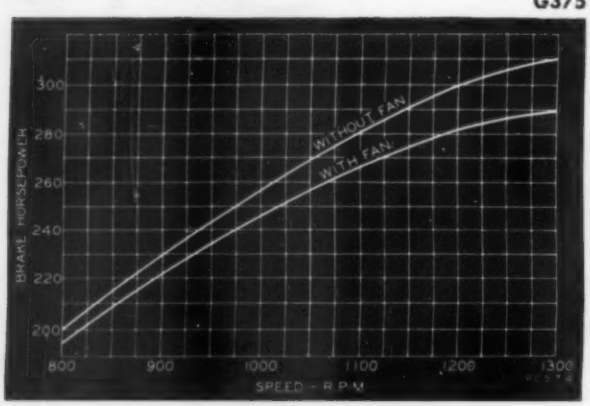
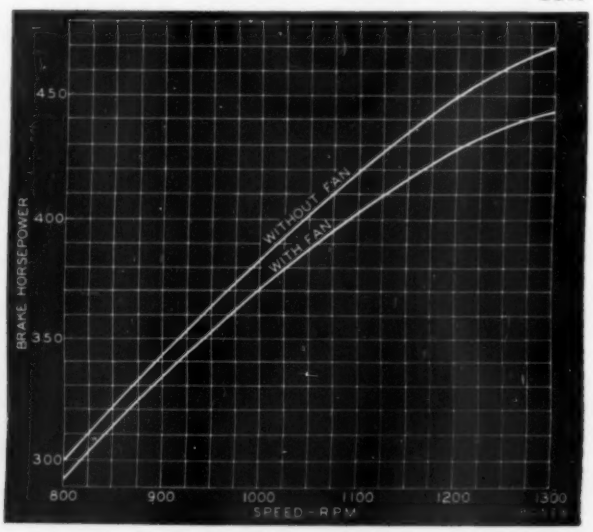
New Horsepower Curves for 10:1 CR Caterpillar Natural Gas Engines

G375



G397



of operation. They have experience records from 10 to 25 years with direct responsibilities.

Charles L. Power is named

C. L. Power

. . . Shreveport district manager of Dowell Division of Dow Chemical Co. Power, who makes the move due to the recent death of former manager Floyd Carr, served as district manager in New Orleans the past 10 years. Power started with Dowell in 1936. He has been in a managerial position since being appointed station manager at Lafayette, La. in 1944. In 1946 he became a development engineer, and later district development engineer in New Orleans. Power moved to sales engineer for the New Orleans area before assuming the district manager post.

John E. Himmelrich is named

. . . eastern regional sales manager of Pittsburgh Coke & Chemical Co.'s Protective Coatings Division, reports Arthur E. Gray, the divisions general manager. Himmelrich succeeds Howard F. Trusler, Jr., who becomes sales manager of the division's regional office at Houston.

Before his promotion, Himmelrich located in Tulsa, where he represented the division's sales in the Central-West. During his 8 years with the company, he has been active on special assignments related to the division's growth program, and has been responsible for sales in Ohio, western Pennsylvania, and West Virginia.

J&L Supply Div. to distribute

. . . flanges, welding fittings, and other products manufactured by Taylor Forge & Pipe Works of Chicago. Taylor also produces spiral-weld pipe, drawn headers, and special rolled and welded pipe in the company's seven plants.

Walworth promotes R. F. Arnold

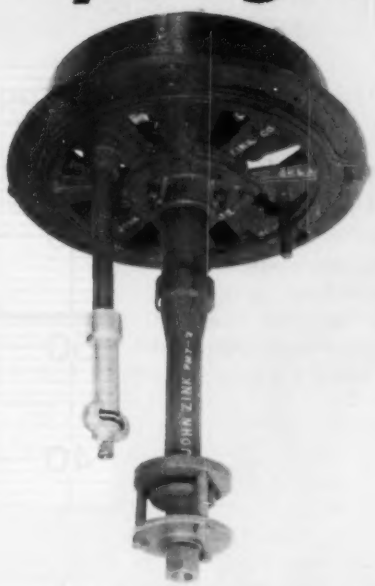
. . . to district manager of the firm's Oklahoma sales. He has moved from Dallas and now locates in Tulsa.

Arnold has been with Walworth Co. 6 years as a salesman in the Dallas, Fort Worth, and Wichita Falls area. He was employed by Remington Rand Co. before going to Walworth.

Midwest Piping Co., Inc. buys

. . . the physical assets of two subsidiaries of Sparton Corp.—Flori Pipe Co., St. Louis, and Houston Pipe &

Burn 90 mol. % Hydrogen



John Zink Series VPM Short Flame Burner

No change in adjustment for shift from "start-up" fuel to high hydrogen fuel.
Highest heat release per cubic foot of furnace volume.
Maximum duty with minimum draft.
Even distribution of heat in furnace.
More than 5 to 1 turn-down.
Capacities from 250,000 to 15,000,000 Btu/hr.

The VPM is ideally suited for firing vertically upward through the furnace floor. Since the maximum draft is at the lowest point in the furnace, the VPM makes full use of all available combustion volume and draft to provide a high heat release per cubic foot of furnace volume.
An extremely short flame pattern is possible with the VPM. This provides even heat at the bottom of the furnace and keeps the flame in the refractory section. However, a variety of spider drillings are available to meet any flame pattern and heat distribution requirement.

Write For Bulletin VPM-457

JOHN ZINK
COMPANY
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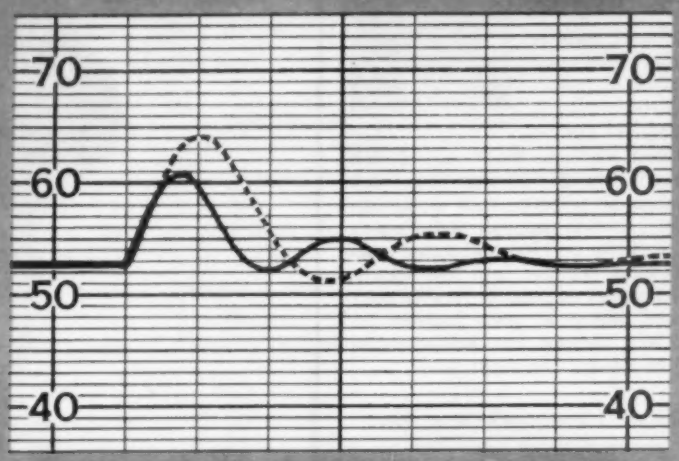
TULSA, OKLAHOMA

86% DIFFERENCE IN CONTROL

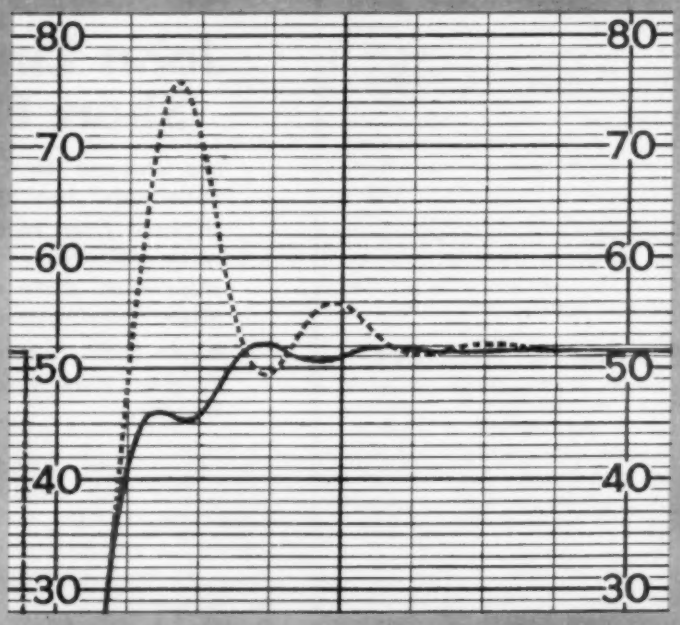
On process load change

The actual area between the recovery curve of the conventional 3-response controller (dotted line) and the set point is 86% greater than that of the Tri-Scope Controller (solid line). Quality of Tri-Scope control is that much better.



On start-up

Here is the perfect solution to your problems of overpeaking on start-up and large load changes—inherent weaknesses of proportional-plus-reset controllers. It is equally effective *at all times* whether variable is approaching control point from above or below—on start-ups, or following major process disturbances or changes in set point.



Taylor Instruments

ONLY 8% PREMIUM IN PRICE!

Taylor TRI-SCOPE* Controller performance records give overwhelming proof of its outstanding superiority

The charts at left show how the full-time use of derivative-ahead-of-reset response in the TRI-SCOPE Controller (solid line) compares with results achieved by a conventional 3-response controller (dotted line).

Quality of control is a function of the *size* of the deviation and the *time* required to regain the control point. Thus, the area under the recovery curve is a measure of quality. Since, with a conventional 3-response controller the area above the control point is 86% greater, then the TRI-SCOPE quality of control is that much better.

The additional cost for these vastly superior control qualities amounts to only 8%, when you consider the price of transmitter, recorder, valve and conventional controller, versus these same instruments and the TRI-SCOPE Controller.

It is a matter of simple economics. If your product is important enough to justify investment in a 3-response controller, 8% is a very small premium to pay for 86% difference in control. *Figure your savings over the life of the instrument!*

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For full details of this unique new controller, see your Taylor Field Engineer, or write for **Bulletin 98332.** Taylor Instrument Companies, Rochester, N.Y., or Toronto, Ontario.

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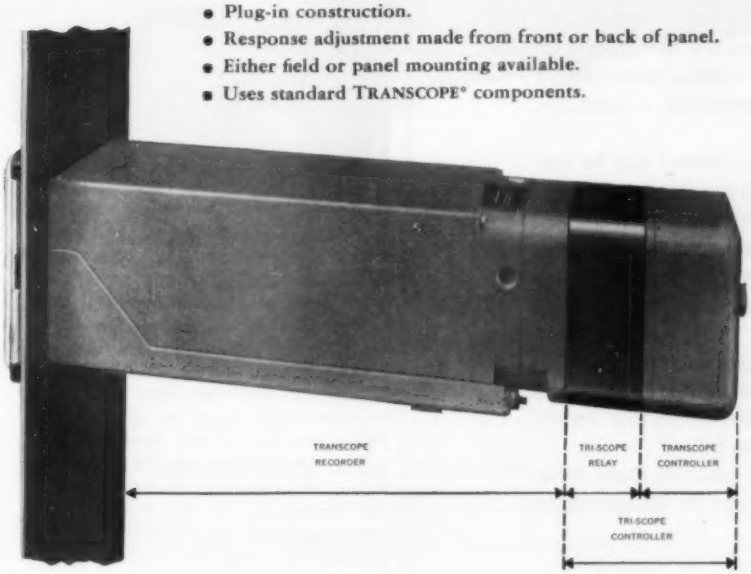
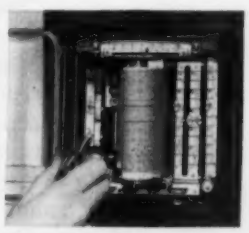
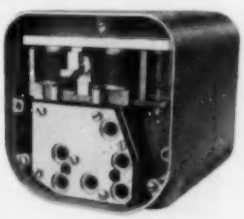
DESIGN FEATURES

- Plug-in construction.
- Response adjustment made from front or back of panel.
- Either field or panel mounting available.
- Uses standard TRANSCOPE* components.





90J SERIES TRANSCOPE RECORDER



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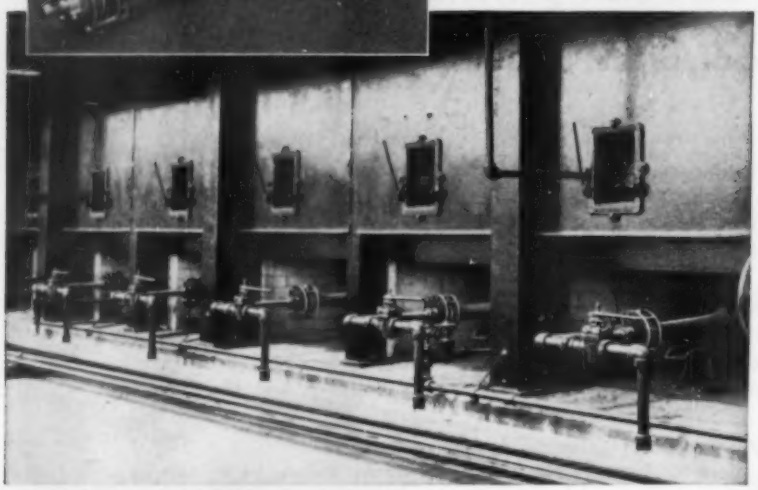

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Steel, Inc., Houston. The announcement comes jointly from O. P. Carter, Midwest president, and John J. Smith, president of Sparton.

Midwest intends to operate both new properties as divisions of the company, retaining present personnel. Midwest also operates two major plants in St. Louis, one in Los Angeles, and another at Clifton, N. J.

Hills-McCanna Co. appoints

. . . Ernie Graves Co. of Tulsa as exclusive representative for diaphragm valves and replacement parts in Oklahoma, southern Kansas, and the Texas Panhandle. Ernie Graves Co. also represents Hills-McCanna metering and proportioning pumps and force-feed lubricators.

Hills-McCanna also named Geo. S. Thomson Co., Inc., El Paso, Tex., as a stocking distributor for diaphragm valves and replacement parts in west Texas and New Mexico.

H. R. Safford receives

. . . a new Business Defense Administration reservist commission from John F. Skillman, director of the agriculture, construction, mining, and oilfields materials division of the Business Defense Administration. Stafford is executive secretary of the Petroleum Equipment Suppliers Assn. The presentation took place at the annual PESA meeting in Boca Raton, Fla.

The Department of Commerce is setting up executive reserves for 125 key industries. In the event of an emergency, the reserve will report to government relocation centers to set up mobilization machinery for the respective industry.

Reserve for the petroleum equipment and service eventually will be made up of 10 or 11 executives. To date there have been 1,000 businessmen certified as executive reservists for 125 industries.

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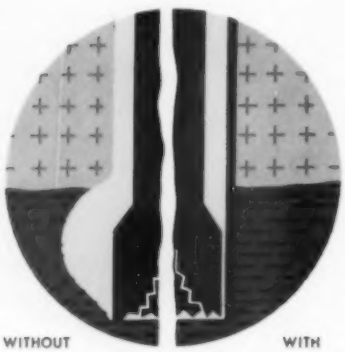
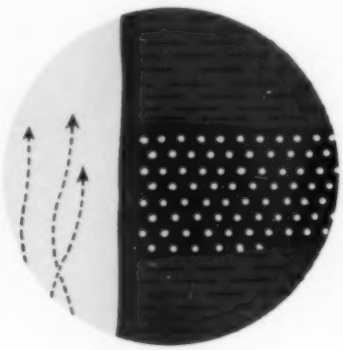


LESS HOLE TROUBLE



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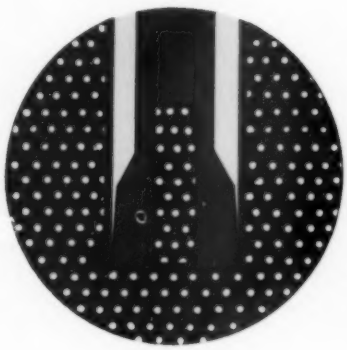

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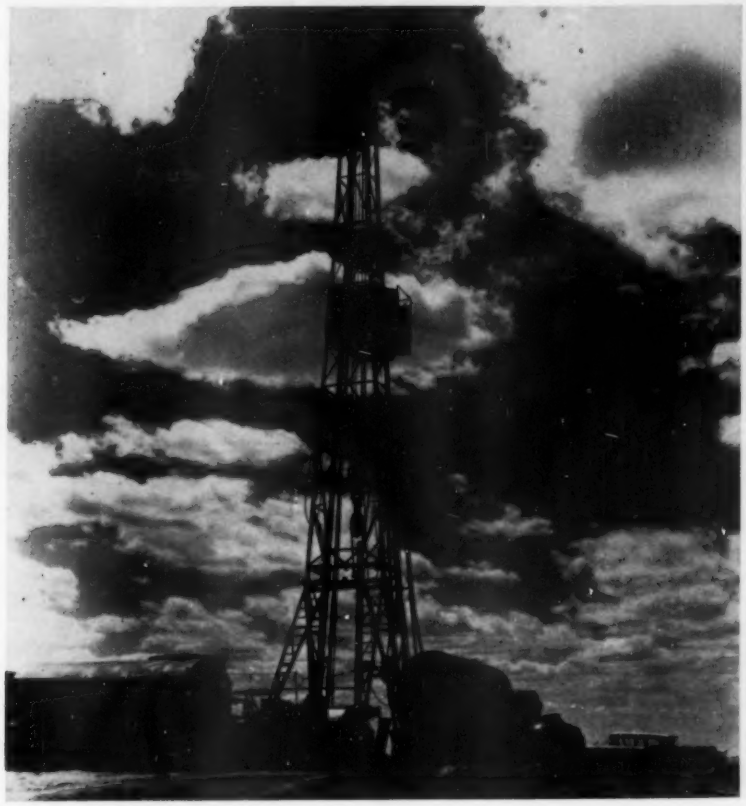


This Empire rig digs

1,000,000 ft. of hole

MORE than 1,000,000 ft. of hole has been drilled with a medium-depth rig owned by the Empire Drilling Co., Wichita. This represents 249 wells at an average depth of 4,016 ft.

The draw works, rotary, swivel, block, and slush pump have completed this footage without a major overhaul. The engines have been overhauled once. The original rotary, suction, and vibrating hoses are still in use.

The rig is a National T-32 with a C-150-B, 7¼x12-in. slush pump and a 96-ft. Lee C. Moore derrick. Power is supplied by General Motors twin-six Model 12103 engines. Other equipment includes a National D-6 traveling block, Type L swivel, and 17½-in. rotary, and Raybestos-Manhattan hoses.

A string consisting of 17,000 ft. of 4½-in. 16.60-lb. Grade D Spang double-seal, shrink-thread drill pipe and 5¾-in. od. API National full-hole tool joints, was used.

Empire is a copartnership between Dan J. Kornfeld and Theodore Gore. Marion C. "Swede" Helberg is drilling superintendent and Robert A. White, Jr., production superintendent.

The rig has been used mostly in northwestern Kansas where Empire and Gore have holdings in excess of 90,000 acres. The company's northwest Kansas district office is at Morland.

New company will operate slim-hole rigs

Rowley Drilling Co. of New Orleans and Natchez has been formed, according to H. L. Rowley, president. The new contracting firm will operate three slim-hole rigs in the Gulf Coast area.

In addition to H. L. Rowley, other officers include Stephen J. Rowley, executive vice president; Philip G. Reynolds, vice president and superintendent of drilling; and Carl B. Kendrick, secretary and treasurer. H. L. Rowley has been a drilling contractor and producer in the oil industry for nearly the past 30 years. Stephen Rowley, Reynolds, and Kendrick are long-time associates of the president of the new firm, having held executive posts in H. L. Rowley, Inc., and other affiliated companies during the past 10 years.

McClure gets drilling firm

McClure Oil Co., Alma, Mich., announced organization of a new firm, McClure Drilling Corp., and the purchase of the rigs, equipment, and buildings of the Gordon Drilling Co., Mt. Pleasant, which will be dissolved.

The purchase included seven rotary rigs. The new company will establish offices in the present Gordon Building, and other Gordon producing and operating companies will move to the vacant building originally used by the Brazos Oil & Gas Co.

Before the purchase McClure's drilling subsidiary was operating two rotary rigs, two combination rigs, and five spudders.

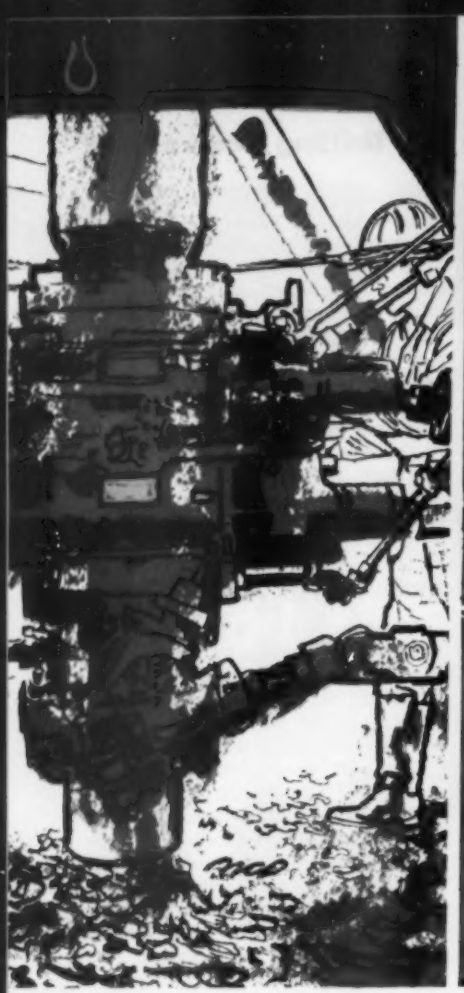
E. H. "Gene" Sloyer, formerly of Wichita, has been named general manager of the drilling company, with Harold McClure, Jr., Alma, president. McClure said his operating company had a minimum 300-well program in southern Michigan during the next 30 months.

Gordon Drilling Co. was organized in 1947 by Earl Hartman, Herbert Moravey, Edward Gault, and Dean Russell.

California firm reorganized

Casey and Montegomery Co., Inc., has been reorganized with new name of R. B. Montegomery Drilling, Inc. The switch was made recently when Jim Casey retired from active ownership of the five-rig company operating out of Bakersfield.

Casey remains as advisor and consultant in field operations while Oscar Loveless, drilling superintendent, steps up as a vice president. Jim O'Neill, formerly district geologist for Oceanic Oil Co., joined the drilling company as geologist-engineer. The company started in 1953 with one rig and now operates five rigs, mostly in the deeper drilling category.



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A TRIPLE-ZONE DISCOVERY has been made at East Linden field, Cass County, Texas. This is Texas' first Cotton Valley oil field. Other Jurassic fields in East Texas area have produced from Smackover limestone along the Luling-Mexia-Talco fault trend.

Cotton Valley makes its debut in Texas

BY FRANK J. GARDNER

EAST TEXAS' faltering Jurassic campaign was jolted anew last week with announcement of the first Cotton Valley oil discovery in Texas. Ever since the first discovery of Smackover oil at Eylau (Bowie County) in 1944, East Texas wildcatters have aimed their bits at the Jurassic, but without much success. Only one additional oil pool and seven tricky gas fields have produced from the deeply buried system.

Now the picture may change. Pan American Petroleum Corp. has reported completion of a three-zone oil strike at its 1 Giraud, a Cass County wildcat 5 miles southeast of Linden, Tex. It is finished in only two of the three pays, all Cotton Valley in age. Total depth of the well is 12,079 ft., plugged back to 10,750 ft.

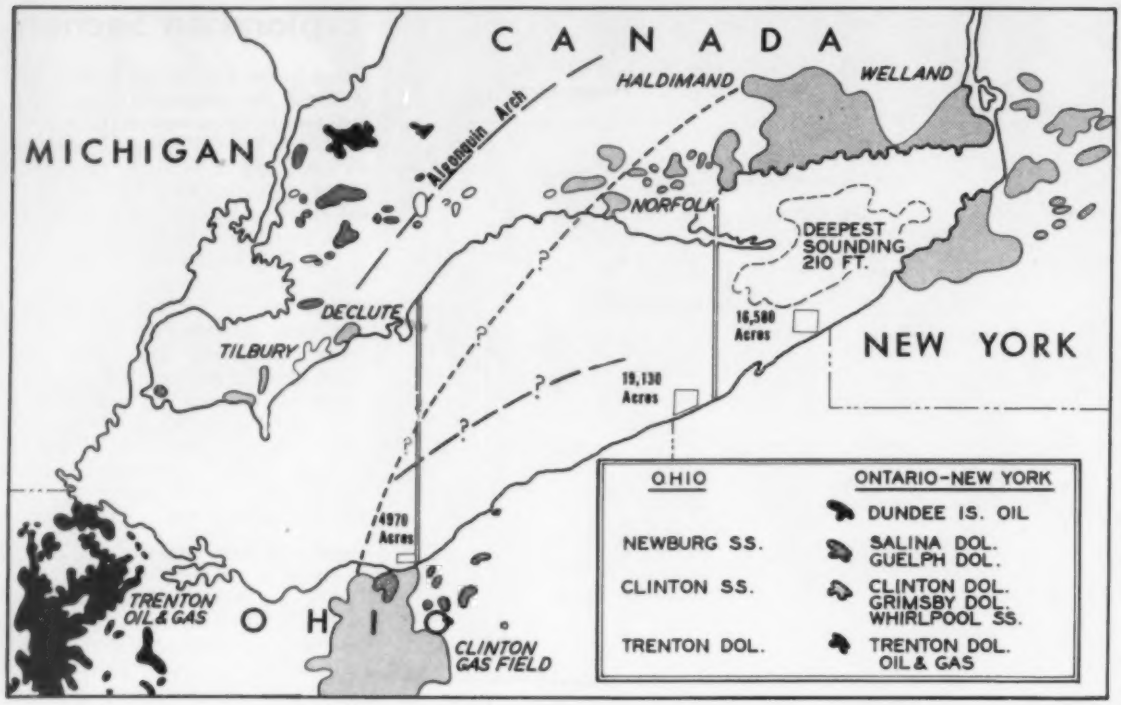
A triple-threat oiler . . . On final potential test, the Giraud discovery flowed 281 bbl. daily on 8/64-in. choke from the lowermost perforations at 10,620-53 ft. and 45 bbl. on 24/64-in. choke from a middle pay at 10,254-62 and 10,278-83 ft. An upper zone, 9,865-75 and 9,951-58 ft., flowed 177 bbl. of oil in 22 hours on drill-stem test, but has been temporarily shut in. Total pay thicknesses were 43 ft. in the lower zone, 36 ft. in the middle one, and 130 ft. in the upper one. Oil gravities in the lower and middle pays were 49° and 43° respectively; gravity of the upper-zone oil was not released. Pan Am holds full interest in the 8,300-acre block surrounding the strike.

This is the most hopeful sign yet posted in the scearch for Jurassic oil in Texas. The original Smackover oil discovery at Eylau was offset by four dry holes. The only other Smackover oil was found at Mexia in Limestone County in early 1955. Both are one-well pools today. The penetration of more than 200 ft. of potential oil pay at Pan Am 1 Giraud is something new in East Texas Jurassic exploration. Across the line in North Louisiana and South Arkansas, both Cotton Valley and Smackover are prolific producers, but Texans have had slim luck with them. Permeability and porosity both decrease to the west; one example: at New Hope field (Franklin County), most promising of the Smackover gas fields, permeability averages a mere .2 md.

Supplies a new objective . . . The "Smackover trend" in East Texas curves in a great arc from the northeastern tip of Texas west and south to Mexia—a 200-mile stretch that logically should be stippled with Jurassic production. But the sorry score is shown on the map. Cotton Valley has not been a prime objective heretofore, although nine gas wells are producing from the formation at Waskom field, Panola County. This Cotton Valley gas was found in 1955, but production has not spread to other fields in the district.

The Jurassic hunt has been a long and costly one, but as encouragements pile up, we can look for an acceleration of the campaign. The oil discovery at Mexia in 1955 triggered the biggest trading spree East Texas had seen in years; leases were taken all along the Luling-Mexia-Talco fault trend. Significantly, the play is beginning to pay off. Last year, three Smackover gas fields (Bloomburg, Fruitvale, and Sulphur Bluff) were uncovered along the trend, to mark the best Smackover year on record. Development drilling in older Smackover fields may also pick up a lot; at New Hope, Tidewater Oil Co. has announced two new tests for the field in addition to one already under way, and the company is said to be planning at least seven such field tests this year.

Pan Am's activities at East Linden will be closely watched for indications of Cotton Valley potential in other parts of East Texas. The operator has applied for triple-completion permit at the discovery, but this must await a July hearing before the Railroad Commission. Meanwhile, a confirmation test, the 1 East Texas Iron Co., is on its way down 4,000 ft. southwest of the 1 Giraud; it is contracted to 11,200 ft.



New legislation in surrounding states offer drillers encouragement as . . .

Tempo quickens on Lake Erie

BY BRYSON C. DONNAN
Consulting geologist, Clarkson, Ont.

THE OFFSHORE gas play in Lake Erie promises to move into second gear in the 1959 season with approximately 110 wells planned.

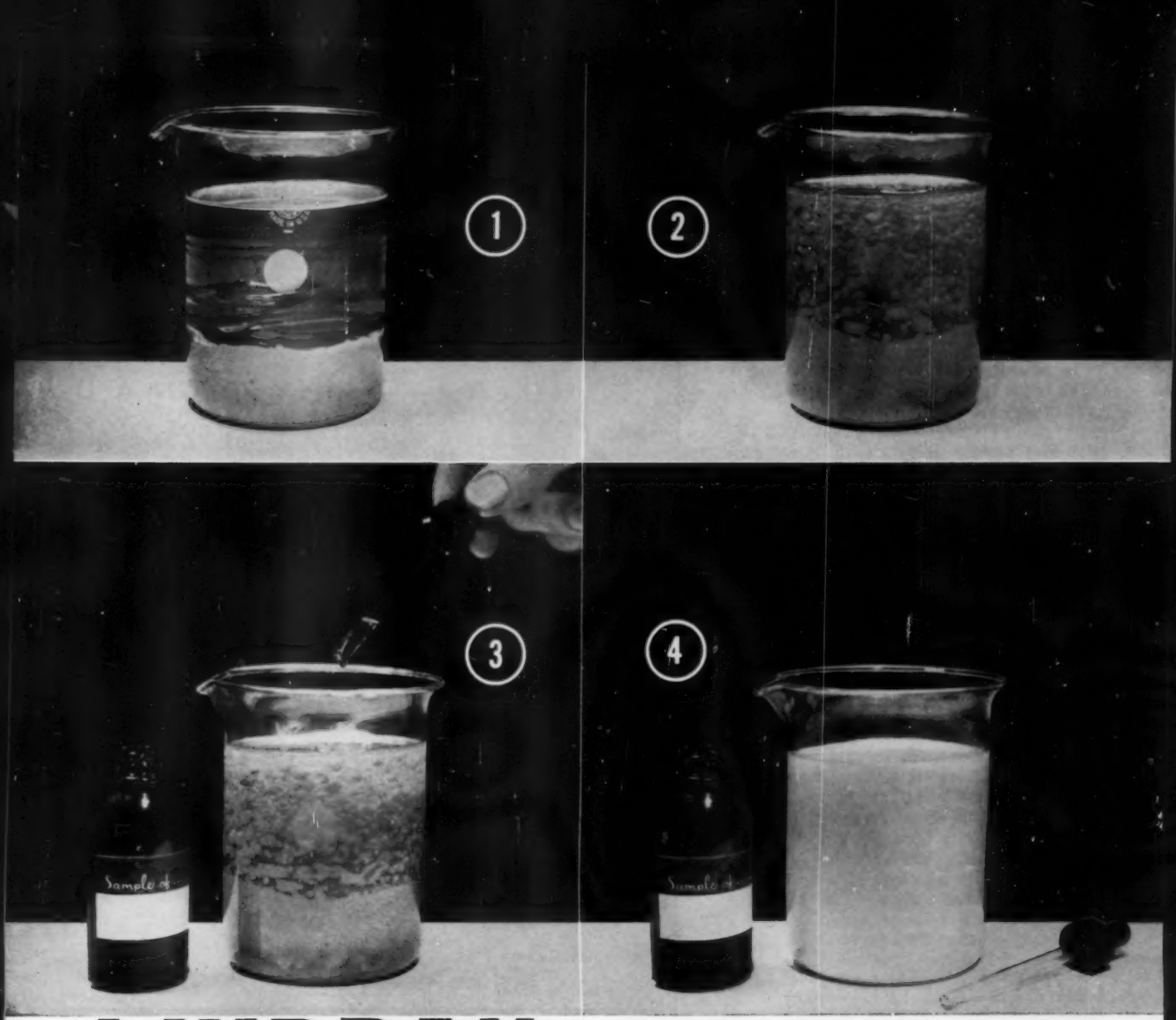
During 1958, 56 were completed including three additional wells being suspended, pending completion in 1959, giving 31 gas producers. During 1959, 15 drilling towers are expected to be in operation with many wells to be drilled from piling platforms as well.

The lake is currently divided into three areas: the western, central, and eastern parts (Fig. 1.)

Western sector . . . The search continues here for production in the Dundee, Columbus, Salina, Guelph-Lockport, Trenton, and Cambrian formations with the emphasis on Guelph reef. Approximately 40 to 45 wells are planned for 1959, with 37 drilled in 1958—3 to be completed in 1959—giving 21 gas producers. During 1958, Consolidated West Petroleum, Ltd., continued to develop the underlake extension of the Tilbury gas field. which now extends 7 miles

About the author . . .

Bryson C. Donnan has had 10 years of varied experience in oil and gas exploration and development in both western and eastern Canada. He was formerly associated with Geophysical Service, Inc.; Royalite Oil Co., Ltd.; Bay Petroleum Corp., and Consolidated West Petroleum, Ltd., the latter being the pioneer company drilling offshore wells in Lake Erie. Since 1955 he has been actively engaged in offshore drilling operations. Donnan graduated from the University of Toronto in 1949 with a B.S. degree in mining geology. As an independent geologist, he is consulting and currently specializing in offshore development of the Great Lakes region.



MUDBAN

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Mudban* is a Dowell product used to help remove mud cake and excess drilling mud from wells; and to help remove mud lost to producing formations. It is added to the oil used in well clean-out work. Mudban is effective on almost all types of muds. The above photographs show how it works.

Photograph number 1 shows the normal incompatibility of drilling mud and oil. Number 2 shows that even vigorous agitation does not mix the two. In photograph number 3, Mudban is being added to the unstable emulsion of mud and oil. The recommended concentration is one to two per cent. Photograph number 4 shows the results. A mild agitation completely disperses the mud, forming a low-viscosity mud-in-oil emulsion.

Mudban is not an acid. It is not intended to be a substitute for either Mud Acid or Breakdown Acid (BDA*). Mudban is strictly a mud dispersing agent. It has proved more effective than acid for its intended use. Mudban can also be added to the oil used to free stuck drill pipe. Ask your Dowell engineer for complete information. Mudban is available through all 165 Dowell offices and service points.

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from shore (61 producers total). Submarine Oil & Gas, Ltd., drilled four successes on its holdings, developing the largest new proven gas reserves found recently on the lake. Numerous other companies encountered significant shows of oil and gas in offshore prospecting in this area with some commercial developments in the offing.

In general, preliminary geophysical work in the form of magnetic or gravity surveys has been conducted over many of the holdings. Seismic exploration was proven satisfactory by Canadian Kewanee, Ltd., without any harmful effects on fish life, in 1958. Much was accomplished in achieving better relations between the petroleum and fishing industries during the past year.

During 1959, a new type of device will be used in an attempt to obtain a comparatively cheap form of continuous seismic profiling. Similar to an ordinary fathometer, a louder and lower-frequency shock wave is achieved with the use of a 10,000-volt underwater electric sparker contained in a water-filled capsule. This reportedly allows reflections from geologic strata 400 to 1,000 ft. below the lake bottom to be recorded, in addition to the reflection from the bottom to itself. The spectrum of energy compares with that of a small blasting cap, and survey results are presented in the form of a geologic cross-section across the area surveyed.

Central sector . . . Three dry holes were drilled during 1958. Activity has been relatively slack for no other reason than that exploration has not yet caught up with this area. One contributing factor to lack of interest in this area may be due to the observation that few gas fields on land offset this area.

Eastern sector . . . Eastern Lake Erie's offshore Medina gas play promises much activity during 1959, with approximately 70 wells planned. During 1958, 16 wells were drilled including 10 producers, and these successes, coupled with good completion results on hydraulic fracturing have led to expanded interest here.

TABLE 1—EASTERN SECTOR PAY FORMATIONS

Lower Silurian:

Clinton dolomite (Irondequoit)—Gas.

Medina sands or Albion sands or "Clinton" of Ohio Thorold light-gray sandstone at base of Clinton dolomite—Gas.

Grimsby (Red Medina) sandstone—Gas.

Whirlpool (White Medina) fine-grained light-gray sandstone—Gas or oil.

Fig. 2.

KEY TO OFFSHORE LICENSE HOLDERS

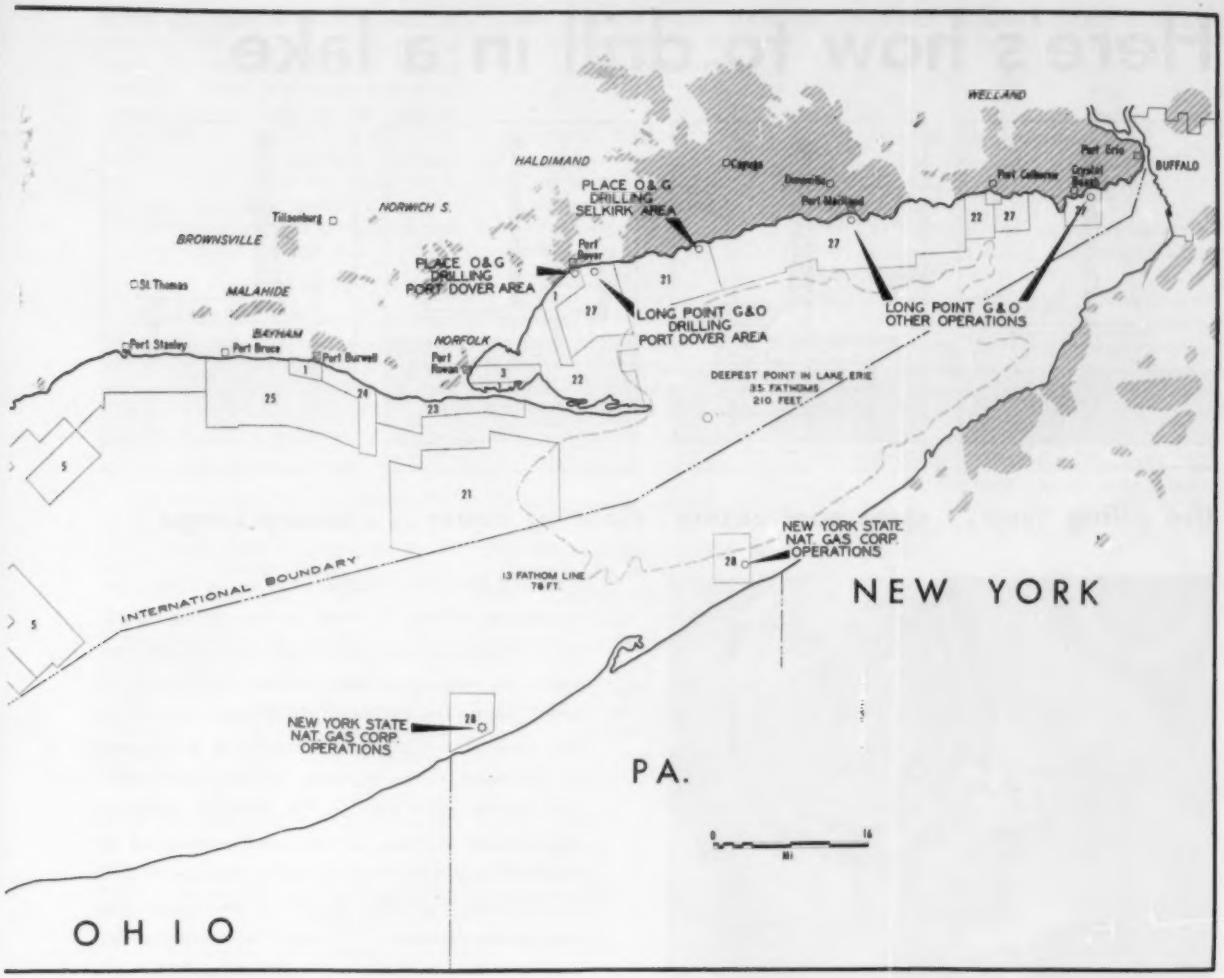
1. Place Gas and Oil, Ltd.
2. Imperial Oil, Limited
3. Bluewater Oil and Gas, Ltd.
4. Harvest Petroleums, Ltd.
5. Matachewan Consolidated
6. French Petroleum Co. of Canada, Ltd.
7. Phillips Petroleum Co.
8. Canadian Kewanee, Ltd.
9. Consolidated West Petroleum, Ltd.
10. Terratest

The table of formations (Table 1) illustrates the pay horizons. These are encountered at approximately 1,100 ft. on the north shore, 1,700 ft. at the International Boundary in Lake Erie, and 2,000 to 3,500 ft. plus in New York State.

Medina gas fields surrounding the east end of Lake Erie are shown in Fig. 2. Production is from the Whirlpool sandstone on the New York side where recoverable reserves run to 3.7 M.M.c.f. of gas per acre—probable average about 2 M.M.c.f. of gas. Some Grimsby (Red Medina) production is found here on the south side of the lake. Expended Medina gas fields are providing valuable storage reservoirs in New York State (Table 2).

Production is from all four zones on the Ontario side, sometimes singly, sometimes in combination. Whirlpool (White Medina) and Grimsby (Red Medina) production may extend continuously beneath the eastern end of Lake Erie between the U. S. and Canadian sides, and it is not known how far production from the Clinton and Thorold zones may extend to the south underneath the lake from the Canadian side. Grimsby sandstone reserves on offshore wells situated close to shore have been subjected to drainage from production onshore on the Ontario side and yet have been conservatively estimated at 1.3 M.M.c.f. per acre. Reserves will probably run higher offshore in the downdip direction to the south.

Recoverable Clinton - Thorold gas



11. Consolidated Golden Arrow
12. Submarine Oil and Gas, Ltd.
13. Uranium Ridge
14. Midcon Oil and Gas, Ltd.
15. Texas Calgary Co.
16. Baska Uranium Mines
17. Canadian Export Gas, Ltd.
18. Lake St. Clair Gas Fields, Ltd.
19. United New Fortune & Imperial Oil, Ltd.
20. Dome Petroleum & North Star Oils
21. Northcal Oils, Ltd.
22. Peace River Petroleums, Ltd. & Foreign Explorations, Ltd.
23. Port Dover Gas & Oil
24. Anchor Petroleum, Ltd.
25. Yankee Canuck Oil & Mining Corp., Ltd.
26. Elro Erie, Ltd.
27. Long Point Gas & Oils, Ltd.
28. New York State Natural Gas Corp.

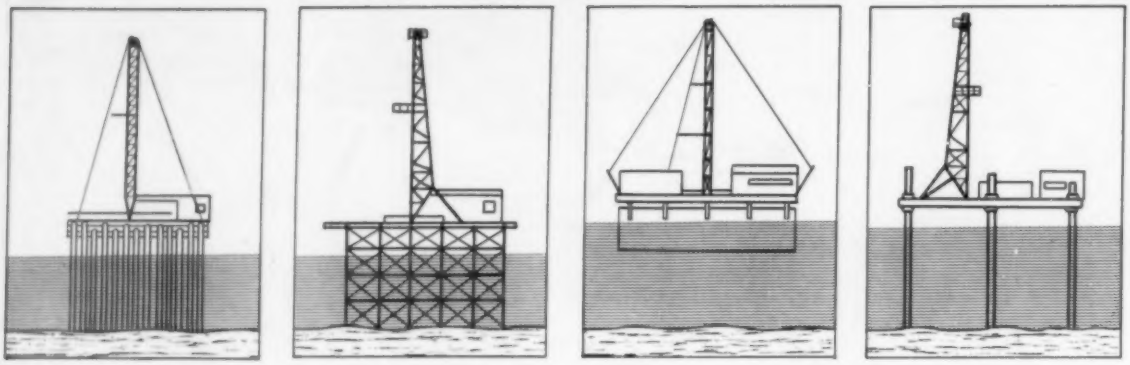
reserves in fields developed on land since 1955 on the Ontario side, with more adequate reservoir information available, have been estimated at 5 M.M.c.f. per acre. In general, daily gas sales depend largely on how much the wells can deliver into the Union Gas Co. of Canada lines, frequently run 25 to 40% of the initial open-flow rates.

Drilling for Medina gas in Ohio has resulted in about 17% dry holes; the same may be expected in Lake Erie. The Medina sands are shoreline deposits, so that lateral changes in sedimentation and cementation would account for this discontinuity in production. It is generally thought that there is very little relationship between structure and production, the occurrences of gas being controlled stratigraphically; for this reason, gravity surveying has not been too popular in the eastern sector. Well spacing currently being used is 320 acres.

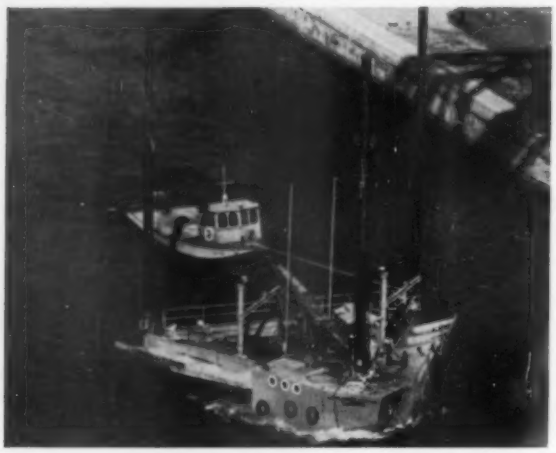
Place Gas & Oil, Ltd., and Long Point Gas & Oils, Ltd., have been the most active companies operating in the eastern area to date. Gas contracts with Union in this area bring 45 cents per M.c.f. as the gas is free of sulfur. Union's base price with Trans-Canada Pipeline is 39 cents per M.c.f. (scrubbed). One could expect this to become the base price for domestically produced gas as well in the whole of the southern Ontario oil and gas province. The Province of Ontario royalty on gas is 3 cents per M.c.f., or 8% of the field price, whichever of the two amounts is the greater.

Hydraulic fracturing . . . Hydraulic fracturing of Medina and similar sand pays has met with considerable success on the American side since 1955, and on the Canadian side since 1958. Initial flow rates have been boosted from 10 to 200 times the original rates, and it is now a rule-of-thumb in certain areas to fracture a well regardless of the size of the initial flow rate. Fracturing a pay zone increases the effective bore radius for improved drainage, possibly increasing recoverable reserves by opening up blind areas which would be otherwise undrainable. Rate of deliverability is improved giving a more rapid payout on wells; as in any well treatment, fracturing cannot be expected to have a uniformly beneficial effect. Generally, following treatment,

Here's how to drill in a lake

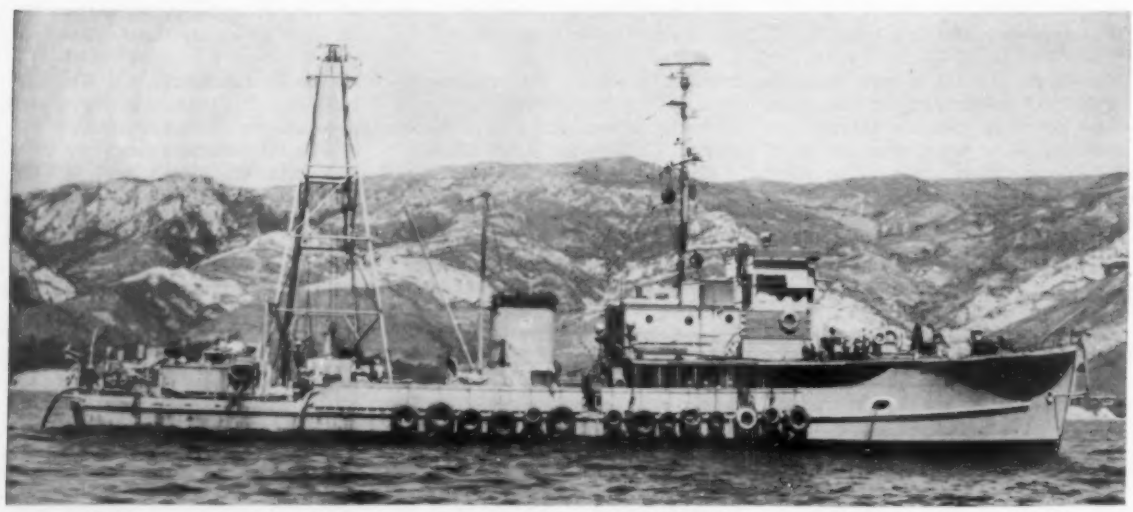


Use piling type . . steel nonfloating . floating tower . . . rotary barge . . .



a new triangle barge . . .

LAKE ERIE DRILLING EQUIPMENT is varied. Basic considerations are the depth of water, drilling target, and short operating season. Objective is fast development and easy portability, without passing up potential pays. The cable-tool rig—long a favorite in both onshore and offshore ventures—is giving way to the faster rotary in some sectors. Combination rigs will be more popular. The types of platforms used indicate different opinions and attitudes of the respective operators. In some areas, permanent drilling platforms constitute hazards to accelerated shipping traffic that the new greater St. Lawrence Seaway system is experiencing. In final analysis, each of the platforms pictured has merit—whether it is a cost or mobility advantage.



or perhaps even a fully equipped drilling ship

flows are reported on the American side to hold up at the high rate of flow for periods of 1 to several months. Then the wells will commence falling back to the original flow rate or greater, and will hold their pressures or decrease gradually over a long period of years on a decline curve. It remains to be seen how fractured Medina production will hold up on the Ontario side.

Future Activity

Legislation in the State of New York will probably be passed soon governing offshore exploration for oil and gas. This should result in offshore acreage blocks offered for competitive bidding there.

Deep Water Play

The 13-fathom (78-ft.) contour (Fig. 4) generally indicates the depth beyond which present equipment could not readily drill in eastern Lake Erie.

Present equipment is meant to include piling towers, portable steel towers, and raisable floating caisson-type steel floating towers. With modifications, tower equipment might handle greater depths to around 17 fathoms (102 ft.). The greatest depth of water in Lake Erie is 35 fathoms (210 ft.).

Given discovery of multiple-pay zones downdip from the Ontario side in future exploration, with a resultant increase in gas reserves from those already established there, it is possible that these greater depths of water eventually will be exploited economically. Drilling vessels could be used similar to those presently in use in offshore exploration in California. Fitted with small rotary rigs, these vessels have been used to drill over 1,000,000 ft. of hole in depths to 650 ft. of water in that state. Combination-type rigs such as rotary and air, or cable-tool and rotary would offset any problems, in mudding-off the pay zones. The speed advantage could be gained with the use of rotary tools to the Clinton formation, then the hole could be cased off and the remaining 175 ft. of pay zone drilled dry by switching to air or cable tools. Air-drilling has been spectacularly successful in cutting costs in drilling for Oriskany gas in Pennsylvania in recent years.

The full width of recommended shipping lanes under the Government of Canada Navigable Waters Protection Act is considered to be one nautical mile. Presently this prevents the location of drilling towers closer than ½ nautical mile. It is possible that special permission might be considered for closer drilling, but if operations with drilling vessels were proven feasible outside of the navigation season with open winter conditions, this would be an obvious answer to drilling development in areas with numerous shipping lanes present.

TABLE 2—NEW YORK STATE GAS STORAGE FROM MEDINA GAS FIELDS

Company, field or area, and county—	M.M.c.f. storage
Iroquois Gas Corp.:	
Bennington—Wyoming	4,000
Collins—Erie	2,600
Derby—Erie	200
Holland—Erie	2,200
Lawtons—Erie	2,100
Nashville—Erie, Chautauqua, and Cattaraugus	8,000
Sheridan—Chautauqua	2,000
Tennessee Gas Trans.:	
Colden—Erie*	10,000
Total	33,100

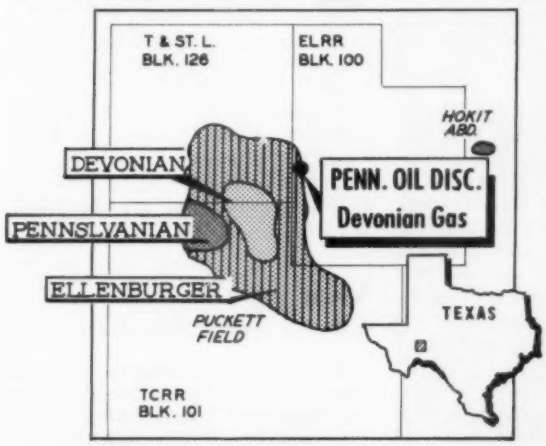
*Under way (working storage).

TABLE 3—APPROXIMATE OVER-ALL WELL COSTS PER FOOT IN LAKE ERIE

	West end*	East end†
Completed-well costs (incl. treatment)	$24.00	$20.00
Dry-hole costs	23.00	16.00

*1,400-ft. well using portable steel towers. †1,400-ft. well using floating towers.

These relatively high drilling costs are offset by very reasonable land-acquisition costs, 100% conversion privileges on leasing, 21-year leases, renewable, and favorable marketing factors.



PENNSYLVANIAN oil has been established at Puckett gas field in Pecos County by Standard of Texas 2-D-1 Mitchell. Shaded areas on the map show Pennsylvanian gas production on the southwest side, and a Devonian gas area in the field's center.

Big Texas field gets new oil pay

WEST TEXAS' biggest gas field has a new oil pay in the Pennsylvanian on its northeast flank, plus an extension to Devonian gas production.

Standard Oil Co. of Texas 2-D-1 Rosa Mitchell flowed 198 bbl. of 49° oil a day from the Pennsylvanian at 10,892-925 ft., following a 20,000-gal. acid treatment.

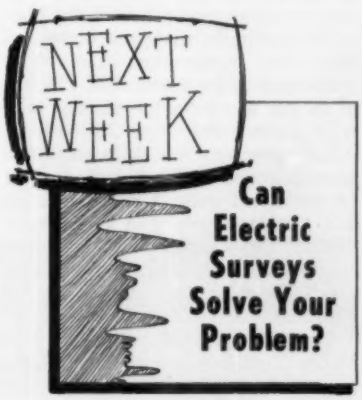
The well was also completed as a gas well from the Devonian at 11,-798-12,073 ft. Gas potential was 4,-850 M.c.f.d., open flow.

Location is in Section 22, Block 100, EL&RR Survey, in Pecos County. The well is on the northeast flank of the field, adjacent Ellenburger production.

Production extended at Ohio field

In Ohio John Lydle stepped out more than a mile south of recent production in Arbutus Glen pool and completed 1 C. E. Hagans, Section 12, Harrison Township, Knox County.

The Clinton sand was logged at 2,738-66 ft. and had a show of oil and gas natural. In a 1-hour test after fracture, well gaged 30 bbl. oil with a gas volume of 1,750 M.c.f.



Here are California highlights:

Independent slates big California gas search

Intex Oil Co., strong Bakersfield independent, has mapped out an extensive natural-gas wildcat program for several Central California counties. Initially, three locations have been staked. They are:

. . . **Contra Costa County.** A 5,000-ft. Domengine sand test will be drilled in this Central California county about 3 miles southwest of the big Rio Bravo gas field. The drill site will be on Jersey Island and will be the first wildcat to be drilled from this spot.

. . . **Sacramento County.** A 4,200-ft. Midland-Meganos sand test will be drilled in the Courtland area of this county. The drill site falls about a mile west of a 5,134-ft. wildcat drilled and abandoned by another operator 6 years ago.

. . . **Solano County.** A 4,700-ft. Wineman sand wildcat will be drilled in this county about midway between Millar and Maine Prairie gas fields.

No spud dates for any of the above tests were immediately announced by Intex.

Stevens production extended at San Emidio

The deeper Stevens zone at San Emidio Nose field in Kern County was extended nearly 3,000 ft. southwest of the zone's discovery well by a Richfield Oil Corp. test in NE SW 9-11n-21w. The new Richfield well, 45-9 KCL H, was completed in the Stevens at 12,047-12,082 ft. flowing 529 bbl. daily of 30.2°-gravity crude through a 17/64-in. choke.

Sooner, Hoosier wells boost output

A Dallas firm, Tekoil Corp., announced new production from two wells in Oklahoma and one in Indiana.

The wells are the 1 Kneedler in Osage County, Oklahoma, which showed an initial potential of 840 bbl. of oil per day; the 1 Mulkey heirs, in Grant County, Oklahoma, which was recompleted for 80 bbl. of oil and 200 bbl. of water per day; and the 6 Kleiderer, in Griffin Consolidated field of Indiana, which was recompleted for 200 bbl. of oil per day.

The Tekoil 1 Kneedler is the seventh extension to the south in East Washunga field of Osage and Kay counties, Oklahoma, and was completed in the Skinner sand through perforations at 2,928-41 ft. The well potentialed 35 bbl. of oil per hour, or 840 bbl. per day, through a 13/64-in. choke. An east extension to the field is already staked in Osage County. Recently, the company completed the 6 Peel in the same field, which showed an initial potential of 335 bbl. of oil per day from the Skinner sand with perforations from 2,926-43 ft. After converting the 5 Boxley to a water-injection well, Tekoil has 11 producing oil wells, 1 water injection and 1 water-supply well in the field.

Tests are being conducted at present to test the feasibility of initiating a miscible-phase drive program in the field.

The Tekoil 1 Mulkey heirs, in Rick Valley Southeast field of Grant County, Oklahoma, was recompleted with production from the Mississippi Chat at 5,200 ft. After fracturing with more than 60,000 gal. of fresh water, the well pumped and flowed 80 bbl. of oil per day. This is an increase from 10 bbl. of oil per day before fracture. Tekoil average production from other wells in the area is about 8 bbl. of oil per day. The company has seven wells in the area and plans to rework them as soon as possible.

Indiana . . . The Tekoil 6 Kleiderer 6, in Griffin Consolidated field just across the Wabash River from Graville, Ill., was recompleted for an initial potential of 200 bbl. of oil per day after fracturing the Benoist, Cypress and Biehl sands with sand and oil. Before rework, the well was producing 6 bbl. of oil per day from the Aux Vases sand. Recompletion of the 5 Kleiderer in the Biehl and the 7 Kleiderer in the Benoist and Cypress is already underway. Tekoil has four producing wells in the field in addition to two water-injection wells and one well temporarily abandoned. Before recompletion of the 6 Kleiderer, production from the lease was only 10 bbl. of oil per day.

Scouts meet in Texas

The National Oil Scouts and Landmen's Association has announced a panel of well-known speakers for its thirty-sixth annual meeting, June 11-13, in San Antonio.

Kenneth H. Shaffer, president of Standard Oil Co. of Texas; Edgar W. Owen, geologist-lecturer, University of Texas; Marvin K. Collie, president, National Bank of Commerce, Houston, and Richard J. Gonzalez, director-treasurer of Humble Oil & Refining Co., will address an all-day session June 13 in the Grand Ballroom of the Hilton Hotel.

Shaffer will talk on "Human Relations in Industry." Owen's topic will be "The Acreage Factor in Oil Exploration." Collie's discussion will be: "Inflation, Growth or Both," and Dr. Gonzalez will speak on "Understanding Percentage Depletion."

Arizona field stretches boundaries eastward

Successful extension of Arizona's East Boundary Butte field is reported by Shell Oil Co. The 23-11 East Boundary Butte, C NE SW 11-41n-28e, Apache County, Black Mesa basin, was completed for 104 bbl. of oil and 774 M.c.f.d. on 20/64-in. choke. Production is from Paradox Pennsylvanian at 4,460-4,608 ft.

This new success is ¾ mile east of last year's Hermosa oil discovery by Humble Oil & Refining Co. That well made 562 bbl. per day on small choke.

Oklahoma wildcat taps Pennsylvania pay

Red Fork Pennsylvania gas production was opened at a Major County wildcat in northwestern Oklahoma. Livingston Oil Co. 1 Keck, C NW NW 14-21n-12w, northeast of Fairview, flowed 3,900 M.c.f.d. on test of the sand at 6,792-6,837 ft. The new find is southwest of big Ringwood field.

Wyoming's Weston County gets wildcat hit

Good Muddy Cretaceous flow was reported at a Weston County wildcat in Wyoming's Powder River basin. Davis Oil Co. 1 Federal-Cellars, NE SE 25-45n-67w, flowed at the rate of 25 bbl. per hour from perforations at 6,664-94 ft. Location is 2 miles south of Lonetree Creek field, another Muddy producer.

Davis also has a discovery in Campbell County, another Powder River area. The 1 Federal in NW NE 2-49n-76w is flowing at the hourly rate of 22 bbl. from Mesaverde. This one is 2 miles north and west of Dead Horse Creek field.

EVER WONDER ??

Geoquestion...

Is it Denver basin, or Denver-Julesburg basin?

Geoanswer

We'll take Denver basin. This is the accepted form today. The basin has been called Denver-Cheyenne basin, Denver-Julesburg basin, and Cheyenne basin. Since Denver and Cheyenne are both in the trough of the basin, these seem more logical since Julesburg is way out on the basin's edge.

Followup well set for East Canada

IN EASTERN CANADA Imperial Oil is today moving a third drilling rig into the Colchester area of Essex County to drill a followup to its oil discovery there.

The rig, a cable tool, is being set up 2,000 ft. east of the discovery well. The new well will be known as Imperial - Harvest - Submarine 3-73-1 Colchester South.

Earlier this month a rotary rig began drilling a followup well 1,000 ft. north of the discovery. This well, known as Imperial Harvest Submarine 2-76-1 South Colchester, is drilling ahead at 688 ft.

Meanwhile, a cable-tool rig has been moved back to the discovery well to probe deeper into the Trenton formation. It is drilling ahead below 2,189 ft.

All three wells are on acreage in which Imperial has a 50% interest, with the remainder split evenly between Harvest Petroleums, Ltd., and Submarine Oil & Gas, Ltd.

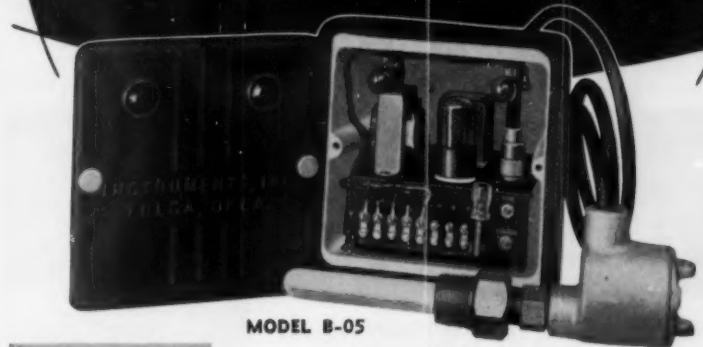
Kentucky depth record shattered

A NEW DEPTH RECORD for Kentucky has been established. The record-breaking well is United Fuel Gas Co. 1 J. W. James on Coldwater Fork 1 mile southeast of Inez in Martin County.

Depth reached was 13,172 ft. presumably in the basement complex although no information other than top of Mississippian Big Lime at 1,088 ft. has been released.

The James test thus surpasses the previous depth record of 11,130 ft. reached only last November.

ELECTR-O-PROBE®
TANK OR BIN LEVEL CONTROL



MODEL B-05

ELECTR-O-PROBE is a super-sensitive, capacitance operated electronic relay for the detection and control of liquid or solid levels, liquid-liquid interface or foam-liquid interface in a closed vessel. ELECTR-O-PROBE will indicate high or low level. ELECTR-O-PROBE may be adjusted to ignore foam or detect presence of foam. ELECTR-O-PROBE contains a hermetically-sealed DPDT relay to actuate alarm lights, horns, pumps or other equipment.

ELECTR-O-PROBE is simple, accurate, dependable and inexpensive.

SPECIFICATIONS

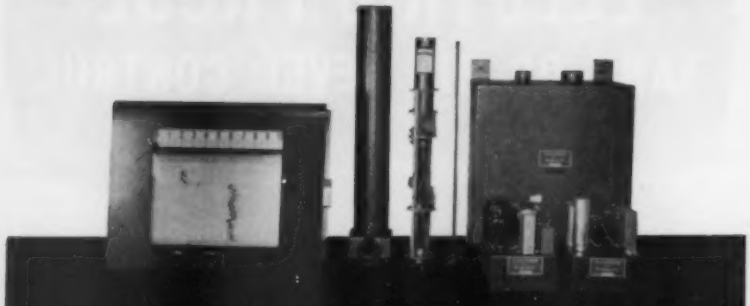
Power Source:	90-135 VAC/60 cps
Power Demand:	9 watts probe immersed 6 watts probe uncovered
Relay:	DPDT hermetically sealed, plug-in
Rating:	5 amps/115 VAC; 2.5 amps/230 VAC
Temperature:	—40° to +450°F.
Pressure:	30" vacuum to 1000 psi
Probe:	Teflon covered
Models:	B-04 — Super-sensitive relay for foam interface, etc. B-05 — General purpose, liquid or solid level detection B-06 — Self-contained, general purpose, tank-side mounting

INSTRUMENTS INCORPORATED TULSA

INSTRUMENTS, INC.
BOX 556 TULSA, OKLA.
PIONEERS IN LEVEL MEASUREMENT AND CONTROL INSTRUMENTATION

MEASUREMENT AND CONTROL UNDER EXTREME OPERATING CONDITIONS . . .

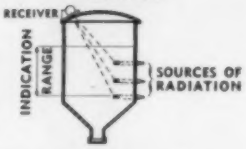
GAGETRON®



for level, specific gravity or interface measurement and control in a closed vessel through nuclear radiation. GAGETRON provides permanent, efficient control and measurement under severe operating conditions in process vessels or piping. Mounted externally or internally. GAGETRON will gage levels continuously or control levels at predetermined points.

Multiple sources of radiation usually required to measure or control level of liquids or solids in closed vessel. Sources arranged vertically on vessel wall. Specific gravity of materials to be measured determines distance between sources. GAGETRON is used NOW for polyethylene, coke and catalyst, uranium ore and liquid ammonia level.

LEVEL

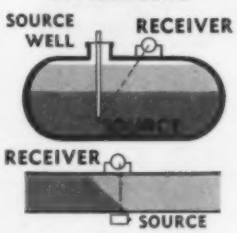


SPECIFIC GRAVITY

GAGETRON may be used to measure and control the density of materials being discharged from a hopper. The specific gravity of practically any material can be successfully controlled. Located outside the vessel, the detecting device is not affected by extreme temperatures or pressures within the vessel. GAGETRON is used NOW for specific gravity control of dextro-maltose syrup, density control on lead slurry autoclaves, specific gravity measurement of ammonia slurries containing solids, density control of asbestos cement slurry.

Detection of interface position between materials having different Gamma ray coefficients can be performed ACCURATELY with the GAGETRON. Tank installations may be made either internally or externally, depending on tank design and user preference. Pipeline installations are easily made by locating source diametrically opposite the detector. GAGETRON is used NOW for interface detection of refined petroleum products in pipeline, acid/hydrocarbon interface measurement in extraction column, interface control of saturated brine/solid salt bed in evaporator, water/acid interface control in settling tank.

INTERFACE



SPECIFICATIONS

Power: 105-125 VAC, 50-60 cps
Output Impedance: 0-500 ohms
Output Power: At 500 ohms impedance, 40 mv. at 10 counts per sec.
Variation of Output: With counting rate at 10 counts/sec. at 500 ohms and 20 sec. counter time constant is 5%. Normal operating condition; 250 ohms output at 70 cps for 40 mv. with 20 sec. time constant variation is 2%.

INSTRUMENTS INCORPORATED TULSA

INSTRUMENTS, INC.

BOX 556 • TULSA, OKLAHOMA

PIONEERS IN LEVEL MEASUREMENT AND CONTROL INSTRUMENTATION

Correction

The author of "Here's Big-Company Approach to Small-Field Profits," on page 275 of May 25 issue of The Oil and Gas Journal should have been listed as Louis A. Newitt, geologist, San Antonio.

New Texas find on Red River arch

A RANK WILDCAT on the Red River Arch of North Texas has been completed as a good flowing well. Shell Oil Co. 1 G. E. Johnson, in central Foard County, tanked 244 bbl. of oil in 24 hours on potential test. Gage was through 21/64-in. choke on tubing, from Des Moines perforations at 5,772-91 ft. Flowing pressure was 80 psi. The Des Moines is comparable to Strawn.

Location of the new well is 4¼ miles northwest of Crowell townsite, in Section 468, Block A, H&TC Survey, A-1003. Nearest production is in Rasberry (6,100 ft., Caddo) field, 7 miles to the west.

Gravity of the oil on final test was not reported. During drilling operations, a drill-stem test at 5,772-92 ft. recovered 40° oil. Formation markers were: Palo Pinto 4,800 ft., Des Moines sand 5,098 ft., Des Moines lime 5,760 ft., and Caddo 5,940 ft. Elevation is 1,451 ft.

Oil play shifts to Nebraska side

THE PENNSYLVANIAN play in northwestern Kansas is moving once more into Nebraska's Hitchcock County. Skelly Oil Co. has an indicated Lansing-Kansas City discovery 2 miles northwest of Burr Oak field.

The 1 Reiher, C NE NE 28-1n-32w, recovered 2,349 ft. of oil on a 2-hour drill-stem test at 3,807-24 ft. There were some smaller shows in the Topeka.

This Cambridge arch area exploration is gaining interest in Kansas, also. Skelly has a discovery prospect at 1 Cahoj in Rawlins County, 14½ miles southwest of the Nebraska well.

Pennsy well drills ahead

Pennsylvania's offshore well, New York State Natural Gas Co.'s Block 2 No. 1 in Lake Erie, is drilling below 400 ft. Elevation is 604 ft., derrick floor. This second U. S.-side wildcat in the lake is 2.6 miles north of 42°15' and .8 miles east of 70°55', off the coast of Pennsylvania.

Small rotary cuts drilling costs 60%

with USS Tiger Brand, America's No. 1 Wire Rope

Still in good condition. Tiger Brand Wire Rope after drilling 20 wells for a total of 18,000 feet.

"This rig is averaging a 1000-foot hole every 40 hours at a cost less than 40% of the original cable-tool method of drilling in this area." These are the words of the owner, Mr. Kenneth C. Keas, Chanute, Kansas.

He goes on to say, "To operate in the shallow pay area (800 to 1100 feet) in which I drill, it is necessary to have a small, highly mobile rig. To operate profitably, it is vitally important to have top-quality equipment. From past experience, I chose USS American Tiger Brand Wire Rope and I can assure you it is more than carrying its share of the load."

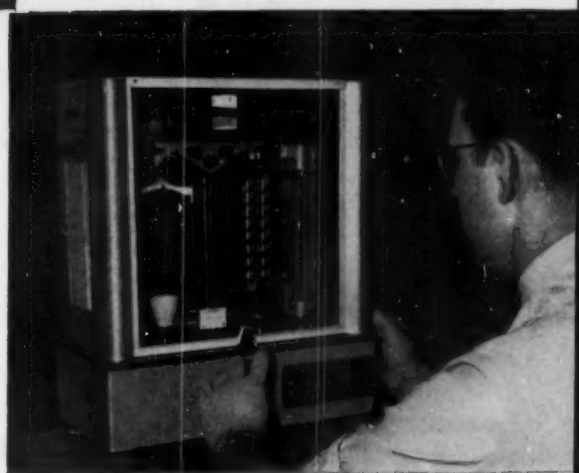
When these photos were taken, the rig was equipped with 450 feet of ⅞" Tiger Brand 6 x 19 right lay, fiber core Monitor Excellay Rotary Drilling Line. It had drilled 20 wells for a total of 18,000 feet. Close examination showed the rope was still in excellent condition.

Tiger Brand Rotary Line is made from USS steel which has the best combination of strength, toughness and wear resistance to give lasting service. What's more, the design is right for rugged oil-field use. You can get Tiger Brand from leading supply stores throughout the oil fields or, for information, write to American Steel & Wire, 614 Superior Ave., N.W., Cleveland 13, Ohio.

USS and Tiger Brand are registered trademarks

Why Tiger Brand is your best buy

1. It is made by a company that maintains the most complete wire rope research and manufacturing facilities in the country.
2. It is designed by one of the country's largest staffs of wire rope engineers. It is serviced by thoroughly experienced field representatives always ready with their assistance.
3. Every type of Tiger Brand Wire Rope is designed for specific applications. You get the *right* rope for the job.
4. It is made by *one* company, U. S. Steel, and every step of production, from ore to finished product, is carefully controlled and supervised to guarantee *one* high standard of quality.
5. Tiger Brand Wire Rope is manufactured by the largest single producer in the country.



American Steel & Wire Division of United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
United States Steel Export Company, Distributors Abroad

Actual case history...

OPERATOR DRILLS 170% MORE FOOTAGE, INCREASES BIT LIFE 67% WITH SEECO-MUL

That's what a division drilling engineer for a major in West Texas reported after completing a 9,700′ well with a Seeco-Mul emulsion. Oil-and-water emulsion drilling fluids are being used extensively by the division, and detailed records were maintained on both field and exploratory wells drilled with company rigs.

Not only did they get the benefit of the extreme-pressure properties in Seeco-Mul, which extended bit life, but also attributed to the Seeco-Mul system were "a more nearly gauge hole, fewer round trips, less wear on the rig and equipment, more rig time in actual drilling, and less wear on pumps, liners, and drill string." Here's what Seeco-Mul did:

- *increased bit life 67%.*
- *increased footage per bit 170%.*
- *increased penetration rate 66%.*
- *saved $9,000 in one interval.*

On another test, this one a slim-hole, "the average rate increased 45% and the footage-per-bit increased 86% in a single 800′ interval. Ten fewer bits were used, and 122 less rig hours, for an estimated savings of $7,500."

And here's what the company said about $2,540 spent for a product specifically sold for bit lubrication: "No increase in bit bearing life or penetration rate was achieved....On the basis of the test results (higher drilling costs with no improvement in bit life), further use was discontinued until more favorable results could be anticipated to justify the added expense."

Seeco-Mul, often run in so-called soap drilling fluids to lower the surface tension, is a chemical emulsifier with superior wetting abilities. In addition, Seeco-Mul is an efficient E-P agent. It deposits an extremely tough lubricating film that will withstand high pressure and successfully reduce metal-to-metal contact of the bearing surfaces in the bit.

Seeco-Mul is making hole faster and saving money for operators from the Gulf Coast to the Permian Basin. If you would like to report similar savings in rig time — increased bit life — more footage per bit — save rig hours — ask your local mud dealer about Seeco-Mul, or write to us for technical literature and a lab sample. We'll be glad to give you full particulars without obligation.

DRILLING PERFORMANCE IN 6⅛" HOLE

Well No.	H-4	D-2
Type Mud	Seeco-Mul CMC low solids	CMC low solids
Interval	9,999-10,787	9,999-10,803
Footage	788	804
Bits	8	22
Rotary Hours	126	210
Rotary and Trip Hours	174	342
Weight	35	25
RPM	38 to 50	60
Feet Per Hour	6.3	3.8
Feet Per Bit	98.5	36.5
Hours Per Bit	15.8	9.5
Penetration Rate Increase	65.8%	—
Footage Per Bit Increase	169.9%	—
Cost Per Foot*	$11.20	$22.54
Mud Cost (including mud-up)	$1,470.00	$1,150.00

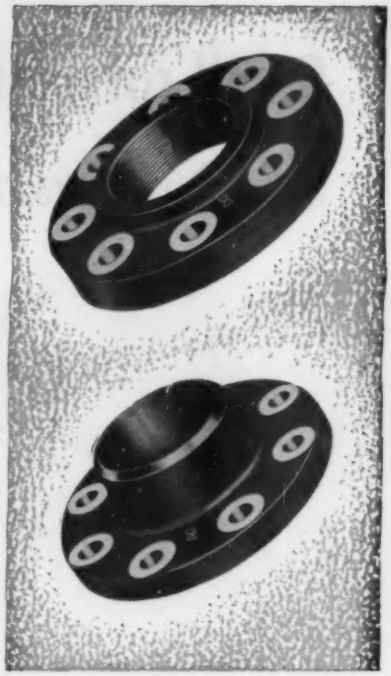
*Total rig time × $45 per hour ÷ number of bits × $124.30 ÷ interval footage.

Make a good mud better...use

CROSSETT **Seeco-Mul** DRILLING MUD EMULSIFIER

Manufactured by the Chemical Division of The Crossett Company, Crossett, Arkansas

Seeco-Mul is the dried flake form of a compound of the sodium salts of abietic, linoleic, and oleic acids, together with quantities of wood tannins and lignins.



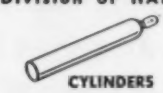
HARRISBURG FLANGES

Harrisburg Drop-Forged Steel Pipe Flanges are made to A.S.A. standards for oil companies, ship builders and pipe fabricators. They come in threaded, butt-welding, slip-on welding, Van Stone and blind types and are shot-blasted and dip-coat finished with a rust preventative black lacquer. Be sure you make it Harrisburg when you want flanges.

More than a Century (H) in Harrisburg 6, Pa.

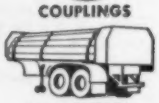
HARRISBURG STEEL CO.

Division of HARSCO CORPORATION


CYLINDERS

COUPLINGS

TUBES


TRANSPORTS

Coming: Special Report On World Oil Congress

OUTSTANDING exploration papers will be covered in next week's special Journal report on the World Petroleum Congress.

Mark June 8 on your calendar and read the Journal for these important features:

1. The Use of Nuclear Physics in Oil Well Surveys.
2. Geological Appraisal of Exploration on Salt Domes.
3. Outlook for Petroleum Exploration.

See next week's Oil and Gas Journal for top coverage of the Fifth World Petroleum Congress.

Arbuckles add new discovery

OKLAHOMA'S Arbuckle Mountain area has an important Ordovician discovery. It is Sohio Petroleum Co.'s 1 Lewis-A in NW NW SE 32-1n-2e, near Davis in Murray County. This strike is on the north side of the Arbuckles in southern Oklahoma.

Discovery allowable was granted in the Bromide sand. McLish sand will get an allowable after dual completion. Flow from the Third Bromide sand at 5,662-72 ft. was 176 bbl. in 9 hours on 20/64-in. choke; 157 bbl. in 14 hours on 14/64-in. choke. The discovery allowable for this zone for a 29-day period is 150 bbl.

Perforations in the McLish at 5,960-68 ft. have yet to be tested for production.

This well was an old dry hole—abandoned previously at 4,056 ft. There may be many more Ordovician fields lying under shallow dry holes in this part of the state where Ordovician exploration has set the exploratory pace in the past couple of years.

Saugus followup completed

Los Angeles County's Saugus field added an extension test on the northeast flank of the field with a completion by Union Oil Co. of California in SW NW 15-4n-16w. The Union well, B-4 N.L.&F., is located about 1,000 ft. northeast of the nearest producer.

Discovery wells

ARKANSAS

Logan County: Anderson-Prichard Oil Corp. 1 Beth Williams, NE NE SW 7-6n-27w, 3¾ miles north of Boonville. IP 409 M.c.f.d., 5 BWPD, 2-in. tubing open, TP 30 psi., perf. 1,131-1,368 ft., and 2,291-97 ft., Atoka. TD 5,815 ft. OWWO, originally drilled and completed by Gulf Oil Corp. as dry hole. New-field.

WESTERN CANADA

Alberta: British American 10-10-41-19 Red Willow, LSD 10, 10-41-19w4. Glauconitic gas well. TD 4,137 ft.

British Columbia: Imperial-Calvan 83-A Altares, 83-A-94-B-8. Bluesky gas discovery. TD 6,848 ft.

Saskatchewan: Fargo-Imperial 10-19-5-33 Alida, LSD 10, 19-5-33w1. Mission Canyon oil discovery. TD 3,963 ft.

Sarcee-Canpet et al. 10-4 Eagle Lake, LSD 10, 4-31-21w3. Viking oil discovery. TD 2,240 ft.

Saskatchewan: Sarcee-Canpet et al. 10-16 Eagle Lake, LSD 10, 16-31-21w3. Viking gas discovery. TD 2,196 ft.

KANSAS

Kingman County: Drillers Production Co. 1 Lock "B," C NW NW 13-30s-7w. IPF 40 BOPD, Mississippian, 4,124-33 ft., 33°. TD 4,133 ft. Opens Lock field in South Central Kansas basin.

Kiowa County: Rupp-Ferguson 1 Parkin, SW SE SW 8-30s-18w. IPF 273 BOPD, Mississippian 4,996-5,019 ft.; 2 M. M.c.f.d. TD 5-115 ft. Opens South Nichols field in Dodge City basin.

Rooks County: Davis Bros.-Transit Drilling Co. 1 Eiler "B," SE NE SW 22-10s-18w. IPP 104 BOPD, Simpson 3,647-54 ft. IPP 155 BOPD, Lansing 3-498-3,554 ft., 30°, 34°. TD 3,675 ft. Opens Eiler field on Central Kansas uplift.

Sheridan County: Imperial Oil of Kansas 1 Pratt Est., C. NW SE 27-8s-26w. IPP 30 BOPD, Lansing 3,786-88 ft. TD 3,970 ft. Opens South Studley field in Dodge City basin.

NORTH LOUISIANA

Bossier Parish: Cox & Walker 1 Horton, C NE SE 11-16n-11w, 2¾ miles southwest of Koran. IPP 42 BOPD (net), 4% water, 20/64-in., 44°, perf. 5,510½-15½ ft., Pettet. TD 6,800 ft. OWWO, originally dry hole drilled by Milton Crow, Inc., et al. Discovery well Spring Branch field.

DeSoto Parish: A. H. Holloway et al 1 Olin Oil & Gas Co., C W½ NW SE 4-11n-12w, 3⅛ mile northeast of Oxford. IP 92 BOPD 20/64-in., 44°, TP 30 psi., perf. 2,727-30½ ft., Paluxy. TD 3,000 ft. Discovery well Memrele field.

Lincoln Parish: California Co. 1 Callaway, 11-19n-4w, 1¼ miles south of Mount Zion. IP 107 BOPD (net), 15% b.s.&w., 24/64-in., TP 375 psi., GOR 6,720 cu. ft. per bbl, perf. 9,726-78 ft., Cotton Valley-Taylor. TD 12,441 ft. Elev. 231 ft., Cotton Valley shale 8,169 ft., Smackover 11,938 ft., Louann salt 12,411 ft. New pay in Hico-Knowles field.

Pure Oil Co. 1 W. B. Holloway Unit, 32-19n-3w. Calculated open-flow potential 6,350 M.c.f.d., 25 BC per M.M.c.f., 57.8°, shut-in TP 3,504 ft., perf. 9,217-24 ft., Cotton Valley. TD 9,254 ft. Extends Ruaton field 2⅜-miles west.

Webster Parish: Robert F. Roberts 1 Adkins, 4-22n-9w. IP 155 BOPD, 6/64-in., 47°, TP 880 psi., perf. 5,620-26 ft., Pettet. TD 5,696 ft. New pay in Shongaloo field.

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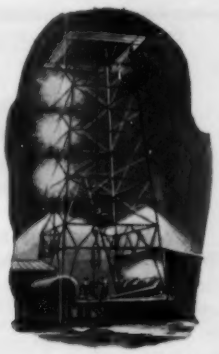

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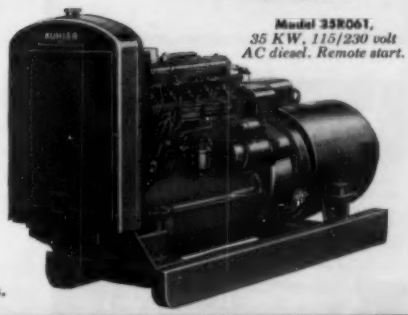

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SOUTH LOUISIANA

Cameron Parish: Tidewater Oil Co. 2 Lacassine, 21-12s-5w, 2½ miles west of Lakeside field. IP 228 BCPD, 2,600 M.c.f.d., ⅛-in., 48.2°, TP 11,300 psi., perf. 16,-112-30 ft. TD 16,267 ft. Discovery well of West Lowry field.

George R. Brown 1 Nunez Unit 1, 29-14s-7w, 2 miles southwest West Chenier Perdue field. IP 76 BOPD, 3,411 M.c.f.d., 10/64-in., 50.8°, TP 6,740 ft., perf. 11,110-15 ft. TD 12,621 ft. Discovery well Oak Grove field.

Jefferson Parish: Shell Oil Co. 2-A Shell-LL&E, 9-18s-24e. IP 301 BOPD, ⅛-in., 36°, GOR 840 cu. ft. per bbl. TP 220 psi., perf. 11,775-83 ft. TD 12,514 ft. New pay in Three Bayou Bay feild.

Jefferson Davis Parish: Aluminum Co. of America 1 Powell Lumber Co., 16-8s-6w. IP 176 BOPD, 5/64-in., 56°, GOR 1,771 cu. ft. per bbl., TP 5,700 psi., perf. 10,414-19 ft. TD 10,750 ft. New-field discovery.

Lafayette Parish: Richardson & Bass 1 Dr. J. P. Mauboules, Jr., 28-10s-2e. IP 91 BOPD, 6/64-in., 48.2°, GOR 5,841 cu. ft. per bbl., perf. 13,886-95 ft. TD 16,000 ft. Extends South Rayne field 1¼ miles southeast.

St. Charles Parish: The California Co. 7 Timken, 35-14s-22e. IP 131 BOPD, 7/64-in., 38.3°, GOR 626 cu. ft. per bbl., TP 1,200 psi., perf. 7,599-7,605 ft. TD 7,764 ft. New pay in Couba Island field.

Terrebonne Parish: The California Co. 1 Continental Land & Fur Co. 8, 35-18s-14e. Shut-in gas well, no gage, perf. 10,735-43 ft. TD 12,310 ft. New field.

MISSISSIPPI

Wayne County: Placid Oil Co. 1 U. S. A., NW NE NE 22-7n-9w. IPP 243 BOPD, ¼-in., 19.1°, TP 150 psi., perf. 8,120-28 ft., Lower Tuscaloosa. TD 13,724 ft. Elev. 236 ft., Lower Tuscaloosa 7,960 ft., Lower Cretaceous 8,496 ft., Hosston 13,252 ft. Discovery well Thompsons Creek field.

NEBRASKA

Banner County: Davis Oil Co. 1 Grant, SW NE 29-19n-55w. IPP 240 BOPD, "D" sand oil discovery, new field. TD 5,764 ft. Skull Creek.

NEW MEXICO

Lea County: Hill & Meeker 1 Gulf-State, 24-26s-32e. IP 62 BOPD, 40°, ⅜-in. choke, GOR 250:1, Delaware 4,697-4,703 ft. TD 4,790 ft.

DeKalb Agricultural Ass'n. 1 Ohio-Federal, 24-9s-37e. IPP 16 BOPD, 29.9°, pay 4,972 ft. TD 5,014 ft.

NORTH DAKOTA

Burke County: Anschutz Oil Co. 1 Oscar Bakken, C SW NW 3-161n-92w. IPF 315 BOPD, Newson discovery, new field in Williston basin. TD 6,861 ft. Klitzke.

OKLAHOMA

Beaver County: Vickers Petroleum Co. 1 Lahaffey, C NW SE 18-1n-25eSM. IPF 5,700 M.c.f.d., lower Tonkawa 5,948-64 ft.; 950 M.c.f.d., Morrow and Chester 8,360-96 ft., 8,428-42 ft. TD 8,510 ft. Triple zone gas discovery in Oklahoma Panhandle portion of northwest Anadarko basin.

NORTH TEXAS

Clay County: Akin & Dimock 1 Sanders, Blk. 60, J. H. Belcher Subd., 2 miles south of Deer Creek. IPP 78 BOPD, 44°, GOR 450:1, Ellenburger 5,948 ft. TD 5,977 ft. Discovery of Sanders-Ellenburger field.

Cooke County: Kay Kimbell 1 W. C. Brownlow, Elizabeth Barnes Sur., A-43, 4 miles east of Callisburg, 1½ miles east of Kimbell Sims field. IP 561 BOPD, 18/64-in. choke, 38°, GOR 281:1, TP 300 psi., pay 6,733 ft. TD 6,738 ft.

WEST CENTRAL TEXAS

Eastland County: B & W Drilling Co. 1 Bible, Henry Applewhite Sur., 17 miles southwest of Cisco. IP 42 BOPD, 7/64-in. choke, 41°, TP 250 psi., pay 2,694 ft. TD 2,703 ft.

Jones County: Joe Saitta, Dorman Anderson 1 Scott-Turner, Sec. 134, Blk. 1, BBB&C Sur., 7 miles northeast of Hamlin. IPP 63 BOPD, 38°, GOR 100:1, Tannehill 2,464-80 ft. TD 2,724 ft.

Parker County: Toto Gas Co. 1 Davidson, Sec. 242, T&P Sur., 4 miles southwest of Poolville. IP 500 M.c.f. of gas, Atoka 4,126-34 ft. TD 4,270 ft.

Shackelford County: J. W. King, Jr. 1-F Coates, Sec. 21, Blk. 13, T&P Sur., 15 miles southwest of Albany. IPP 19 BOPD, 38°, GOR 200:1. TD 1,850 ft.

Stephens County: Eldorado Oil & Gas Co. 4 State Lease, Clearfork of Brazos River, 8 miles south of Woodson. Dual completion. IP 231 BOPD, 25/64-in. choke, 40°, GOR 815:1, TP 380 psi., upper Caddo 3,516-26 ft.; IP 612 BOPD, 14/64-in. choke, 41°, GOR 916:1, TP 510 psi., Mississippian 4,362-74 ft. TD 4,385 ft., ground elevation 1,118 ft.

Taylor County: Jocelyn-Varn Oil Co. 1 E. D. Stevens, Sec. 145, Blk. 64, H&TC Sur., 2 miles east of Shep. IP 112 BOPD, 16/64-in. choke, 37°, GOR 830:1, TP 50 psi., upper Fry sand 4,685-90 ft. TD 4-812 ft., ground elevation 2,207 ft.

Throckmorton County: Tennessee Gas Transmission Co. 1-A Massey, Sec. 1637, TE&L Sur., A-476, 6 miles south of Throckmorton. IP 72 BOPD, 24/64-in. choke, 38°, GOR 1120:1, TP 20 psi., Atoka conglomerate 4,628-32 ft. TD 4,843 ft., elevation 1,362 ft.

WEST TEXAS

Andrews County: Continental Oil Co. 1 Kemper, Sec. 11, Blk. A-44, PSL Sur., 3 miles southeast of Andrews. IP 785 BOPD, 24/64-in. choke, 39.5°, GOR 560:1, TP 500 psi., Pennsylvanian 9,111-21 ft. TD 13,434 ft., PB 9,560 ft. Ground elevation 3,140 ft.

Irion County: Woodward, Turner & Webb 3 Brooks, Sec. 15, Blk. 3, H&TC Sur., 6 miles east of Mertzon, new-pay discovery in Brooks field. IPP 55 BOPD, 35°, San Angelo 1,207 ft. TD 1,213 ft.

Runnels County: Karl Hoblitzelle 1 L. S. Evans, W. Brandt Sur. 12, 2 miles southeast of Norton. IP 1,510 M.c.f.g., gas-liquid ratio 166,000:1, 48°, Caddo 4,756-62 ft. TD 4,855 ft. Opens North Motley (Caddo) field. Originally drilled dry to 4,713 ft.

UTAH

San Juan County: Triton Oil Co.-W. J. Owen 1 Bluff Bench, NE NE 32-38s-22e. IPP 91 BOPD, Hermosa discovery, new field. TD 5,940 ft.

WYOMING

Sweetwater County: Texas National Petroleum Co. 1 UPR-Rock Springs Grazing Association, SW NE NE 17-20n-99w. IPF 9,200 M.c.f.d., open flow, Almond discovery, new field. TD 7,589 ft. Baxter. Green River basin discovery.

Researcher Passes 100 Mark

. . . in patent assignments for Esso. Subjects covered in brilliant career read like cross-section of refining.

THERE'S an interesting story behind U.S. Patent No. 2885347.

On the surface it deals with a new hydroforming operation in producing naphthas of improved volatility for blending in premium gasoline.

It was issued in the routine manner on May 5 and assigned to Esso Research & Engineering Co. by one of its research associates.

But for this research associate the event was far from commonplace. It marked the 100th time that Charles E. (Cy) Hemminger had been issued a patent since he joined the company in 1937.

The veteran Esso researcher obtained his first patent at Esso in 1940. It covered the combustion of carbon from catalysts. He's had at least one every year since then. He hit a high point of 15 in 1944 and had 10 in 1956. Out of the 100, he has obtained 82 as the sole inventor.

Subjects covered by Hemminger's many patents read like a cross-section of petroleum refining. Thirty-seven cover catalytic cracking, 18 catalytic reforming, 16 hydrocarbon synthesis, 6 on coking, and 5 on gasification. He has obtained four covering shale oil and the others are on miscellaneous subjects.

Cy Hemminger
. . . sticks to his laboratory.

Sticks to research . . . Hemminger is a member of a widening clan of talented men who have devoted their lives to research and are sticking to that field.

This devotion is made possible by a new research-management policy adopted by Esso and other firms several years ago. Aim of the policy is to make research financially attractive so that experienced men aren't lured off into the often more profitable administration field.

This permits a researcher to stay in his chosen field. He can make the same economic gains as his administrative-minded colleagues and still gain the gratification and personal reward that comes from making achievements in research.

Hemminger officially is a senior engineering associate at Esso. He has held that position since 1946 and was one of the first four men at Esso Research to hold this title.

Ivy leaguer . . . As a native Pennsylvanian (Rockwood), Hemminger came by his Ivy League background naturally.

He attended Mercersburg Academy and then Princeton where he was graduated in 1925 with a B.S. in physics. He went on the MIT for an M.S. in chemical engineering which he obtained in 1928.

Hemminger's first job was with Standard Oil Co. (Ind.) where he stayed 1½ years before joining Combustion Utilities Corp., a Cities Service affiliate. He remained on this job 7 years.

In 1936 Hemminger came to Standard Oil Co. (N.J.) when its development division was formed.

His present career is simply the outgrowth of an early interest in making new things tick. When Hemminger came to Jersey Standard, he already had six patents to his credit. Four of these he obtained while working with Combustion Utilities. The other two were obtained while he still was in college.

In fact, his first patent application involved the free-piston engine—a red-hot subject even in today's energy picture.

▶ ▶ ▶ Personals

James Comerford, president of Consolidated Natural Gas Co. since 1955, has been elected chairman. He will continue as chief executive officer. **E. H. Tollefson,** formerly executive vice president, has been elected president and chief operating officer.

W. K. Warren, chairman of Warren Petroleum Corp. and a director of Gulf Oil Corp., has been elected chairman of the board of Transwestern Pipeline Co. **John R. McMillan,** president of Monterey Oil Co., has been named vice chairman of the board. **J. R. Butler,** Houston, has been named chairman of the executive committee and secretary and treasurer of the company. Warren, McMillan, and **Mills Cox,** Transwestern president, are other executive committee members.

J. Kenneth Koster, manager of construction for B. F. Goodrich Chemical Co. in Cleveland, has been named manager of production and engineering at the company's Calvert City, Ky., general chemical plant.

G. Montgomery Mitchell, formerly pipeline construction superintendent with Felmont Oil Corp. in Bradford, Pa., has joined Stone & Webster Service Corp. in New York as senior engineer in the gas department.

Jack W. Boone, formerly petroleum engineer with Stephens Oil & Gas Corp., Lubbock, Tex., has joined Fred L. Oliver & Associates, Dallas consulting firm. He will specialize in reservoir engineering. Boone was Wichita Falls, Tex., division reservoir engineer for Shell Oil Co. before joining Stephens Oil & Gas.

W. K. Sanders, president of Trunkline Gas Co., subsidiary of Panhandle Eastern Pipe Line Co., has been elected a director of the parent company. He succeeds **M. K. Hager** on the Panhandle board. Hager recently retired as vice president in charge of operations and a director.

J. G. Dickinson, vice president and supervisor of production in the Amarillo, Tex., office of Natural Gas Pipeline Co. of America, has been elected senior vice president of the company. Three vice presidents have been named. They are **Keith Bentz,** formerly assistant vice president of operations; **F. P. Burns,** assistant vice president of production; and **C. B. Randall,** director of tax and insurance. **J. M. Durrett,** Amarillo office manager, has been elected assistant secretary of the company.

▶ ▶ ▶ Personals

Norman Hardy, president of Arabian American Oil Co., has moved up to chairman of the board, succeeding **Fred A. Davies,** who has retired. Hardy will continue as chief executive officer. **Thomas C. Barger,** vice president, assistant to the president, and a director of Aramco since 1958, has been elected president. Hardy and

HARDY

BARGER

Barger will continue to headquarter in Dhahran, Saudi Arabia. In other changes, Aramco has elected 3 new directors. They are **John Noble,** president of Trans-Arabian Pipe Line Co., and two Saudi Arab leaders, **Shaikh Hafiz Wahba** and **Shaikh Abdullah H. Tariki.** The two were elected to the board in keeping with an agreement of several years standing between Aramco and the government. Both men have had wide experience in government affairs. Shaikh Wahba represented Saudi Arabia at the Court of St. James, London, from 1930 to 1956. He was special delegate to the United Nations conference in San Francisco in 1945. Shaikh Tariki, now director general of petroleum and mineral affairs for his government, is devoted to increasing the income and the role of Arab countries in the Middle East oil industry (OGJ, May 18, p. 179). He is a graduate of the University of Cairo and did post-graduate work at the University of Texas. Before returning to Saudi Arabia he worked as a trainee with Texaco, Inc., in West Texas and California.

Robert M. Youngs, formerly president of Louisiana Land & Exploration Co., has been named chairman of the board. **Jack O. McCall,** first vice president and a director of the company, has been elected president.

George G. Montgomery, president of Kern County Land Co. since 1954, has moved up to chairman. He will continue as chief executive officer. **John T. Pigott,** formerly chairman, has been named chairman of the executive committee and will continue as a director. **Dwight M. Cochran,** executive vice president, has been elected president.

A. J. (Gus) Keller, geologist with Cities Service Oil Co., has been transferred to Casper, Wyo., from Billings, Mont.

Roger G. Hubbell, formerly with Continental Oil Co. in Denver, has joined the production and exploration department in Monsanto Chemical Co.'s Lion Oil division there.

J. W. E. Edmonson, geophysicist with P. E. Narvarte, San Antonio consultant, has been elected president of the Geophysical Society of South Texas, a section of Society of Exploration Geophysicists. Other officers include **P. J. Rudolph,** Petty Geophysical Engineering Co., vice president; **Donald W. Jones,** Sun Oil Co., secretary-treasurer; and **W. Harry Mayne,** Petty Geophysical Engineering, district representative to Society of Exploration Geophysicists.

T. B. Hudson, Phillips Petroleum Co., has been elected president of Fractionation Research, Inc., nonprofit cooperative research corporation which is supported by 58 companies. **D. W. Wilson,** Arthur G. McKee & Co. and **E. W. Volkmann,** Koppers Co., have been elected vice presidents of the company. **Paul J. Parker,** Phillips, is secretary-treasurer. **W. F. Martin,** Phillips, and **Lucille S. Coleman,** Fractionation Research, will serve as both assistant secretary and assistant treasurer. **R. E. Arnold,** Phillips, is assistant secretary.

Kuwait Oil Co. has revamped its operating field personnel set-up with creation of five new assistant general managers under **L. T. Jordan,** general manager in Kuwait. The appointments were effective June 1 when **William Fraser** took over as managing director of the company in London. Fraser succeeded **Sir Philip Southwell,** who has retired (OGJ, Jan. 5, 1959, p. 171). The new assistant managers include **A. G. T. Taylor,** promoted to assistant general manager in charge of management services; **W. C. Buie,** formerly general superintendent of production operations, now assistant general manager for oil; **D. G. Hitt,** assistant general manager, refinery and marine operations; **R. K. Blackwood,** formerly chief engineer, promoted to assistant general manager, technical services; and **J. M. Dougary,** assistant general manager, personnel. Also, **L. M. Craig,** formerly general superintendent of pipelines and export, will head a new and greatly expanded public relations department. **L. J. Cotterill** will head the engineering department as chief engineer under Blackwood.

A. J. Saxe, vice president and a director of South Penn Oil Co., has been promoted to senior vice president in charge of production and exploration. A graduate of Lehigh University, Saxe joined South Penn on a full-time basis in 1936.

H. E. Prokesh, regional geophysicist in Fort Worth for Continental Oil Co., has been promoted to exploration manager for the southwest region. He succeeds **J. E. Finley,** who has taken a year's leave of absence to attend Massachusetts Institute of Technology under the Sloan Fellowship program. **G. H. Swenumson,** Roswell, N. M., division geophysicist, moves in to succeed Prokesh as regional geophysicist in Fort Worth. **V. H. Waddell,** Midland, Tex., geophysical supervisor, will succeed Swenumson.

Augustin Pyre, manager of Western Hemisphere exploratory operations for Gulf Oil Corp., has been assigned to Gulf Eastern Co. in London as manager of exploration. He succeeds **E. S. Bleecker,** who will retire later this year. **T. A. Kibby,** assistant chief geologist in Caracas for Mene Grande Oil Co., will succeed Pyre as manager of Western Hemisphere exploratory operations. Effective June 1, these activities will become a separate operating element in the production department, responsible for conducting exploration activities in the Western Hemisphere outside of the U. S., Canada and Venezuela. Pyre was staff assistant to the exploration coordinator of Gulf Eastern in London before being appointed manager of Gulf Oil's New York exploration division in 1956. Kibby has been chief geophysicist, and assistant production department superintendent of the eastern district for Mene Grande in Venezuela.

PYRE

C. N. Brooks, general manager of the foreign-operations department, Eastern Hemisphere, for Texaco, Inc., and a director of California Texas Oil Co., has been elected vice president, foreign operations, Eastern Hemisphere for Texaco. **Greer Orton,** assistant to the chairman of the board and formerly Texaco's senior representative in London, has been elected treasurer of the company. He succeeds **Stanley T. Crossland,** who has been elected vice president, finance and economics. Crossland succeeds **Robert Fisher,** who has retired.

▶ ▶ ▶ Personals

Lee C. Vogel and **Burton B. Sandiford** have been promoted to senior research chemists at Union Oil Co.'s Brea, Calif., research center.

Jack Mills, district geologist in Bismarck, N.D., for Texaco, Inc., has been transferred to Casper, Wyo., in the same capacity. **Kenneth Harding** will succeed Mills in Bismarck.

L. D. Oster, formerly assistant to the manager of Continental Oil Co.'s headquarters geophysical section in Houston, has been named division geophysicist in Salt Lake City.

MARTIN

Pat T. Martin, tool pusher in the Lindsay, Okla., area for Warren-Bradshaw Drilling Co., has been promoted to Oklahoma Panhandle district drilling superintendent. He will headquarter in Lindsay. He succeeds **Jess L. Gilbert,** who has been transferred from Oklahoma City to Odessa, Tex., where he will be West Texas-New Mexico district drilling superintendent.

R. R. McCarty, Humble Oil & Refining Co.'s western division superintendent in Midland, Tex., has been named division manager of production. **Harold L. Hensley,** assistant division superintendent in Midland, and **J. S. Boldrick,** New Orleans assistant division superintendent, have been appointed division operations superintendents in Midland. **Henry E. Meadows,** assistant division superintendent, has been named division engineering coordinator. **A. J. Bedford** will be western division administrative coordinator. The changes are part of a decentralization plan which Humble started earlier this year.

R. K. Tracy, Humble Oil & Refining Co.'s Gulf Coast division production manager, has been promoted to assistant manager of the production department. He succeeds **R. E. Bridges,** who has retired after 36 years with the company. Bridges has also served Humble as Gulf Coast division petroleum engineer and superintendent. **John S. Bell,** manager of Humble's California area operations, will succeed Tracy as production manager of the Gulf Coast division. He will headquarter in Houston. **Richard E. Faggioli,** California area geologist, will be acting manager of the California area.

Theodore Gupton, management engineer with Pipe Line Technologists, Inc., Houston, has been promoted to vice president, engineering.

Ernest R. Frazier, district petroleum engineer for Magnolia Petroleum Co., has been transferred to Electra, Tex., from Drumright, Okla.

Mike E. Harrell, production engineering trainee with Shell Oil Co., has been transferred to Houston from Denver.

T. E. (Bill) Nissen, senior production foreman with British-American Oil Producing Co., has been transferred to Kimball, Neb., from Sterling, Colo.

Charles J. DeLancey, geologist with Humble Oil & Refining Co., has been transferred to Houston from Los Angeles.

Bryan Sutherlin, production engineer for Lone Star Producing Co., has been transferred to Shreveport, La., from Athens, Tex.

Dr. Richard A. Geyer, chief geophysicist in the gravity department of Geophysical Service, Inc., Houston, has been named manager of the department. He succeeds **F. E. Romberg,** who was recently named chief geoscientist in the new geoscience and instrumentation division of Texas Instruments, Inc., parent company of GSI.

Eddie G. Durrett, manager of Delta Drilling Co.'s West Texas division, and **Harold J. Magner,** Pittsburgh division manager, have been elected vice presidents. Durrett will be in charge of West Texas-New Mexico division operations. Magner will be in charge

DURRETT

MAGNER

of the northeastern division. Durrett was with Loffland Brothers Drilling Co. before joining Delta in 1952 as drilling superintendent in West Texas. Magner has served the company as Evansville, Ind., office manager and assistant manager. When the office was moved to Pittsburgh from Evansville he became division manager.

George R. August, formerly chief petroleum engineer for American Independent Oil Co. in the Neutral Zone, has been transferred to the company's San Francisco office as coordinator of exploration and production. August was senior petroleum engineer with Arabian American Oil Co. in Saudi Arabia before joining American Independent. He was also principal reservoir engineer for the Long Beach Harbor Department and drilling and production engineer with Long Beach Oil Development Co. at one time.

Leonard V. Lombardi, division geophysicist with Gulf Oil Corp. in Fort Worth, has been transferred to Houston as production division geologist. Lombardi has been with Gulf since 1953.

B. B. Lane, formerly petroleum engineer with Sohio Petroleum Co. in Oklahoma City, has joined Graridge Corp. in Breckenridge, Tex., as water flood engineer.

E. T. Benson, Service Pipe Line Co., has been elected president of Tulsa Geological Society. He succeeds **August Goldstein, Jr.,** Bell Oil & Gas Co. Other newly elected officers are **W. O. Andress,** Blackwell Oil & Gas Co., first vice president; **John Woncik,** Apache Oil Corp., second vice president; **J. E. O'Brien,** W. C. McBride, Inc., secretary; **D. L. Hansen,** Sinclair Oil & Gas Co., treasurer; and **B. N. Rolfe,** Cities Service Research & Development Co., editor.

Frank C. Folger, assistant manager of Sunray Mid-Continent Oil Co.'s engineering division in Tulsa, has been transferred to the Gulf Coast division office in Houston as division engineer. **W. C. Doss,** Tulsa material-purchasing department, will be purchasing coordinator in the Gulf Coast division. Also moving to Houston will be **Ralph Detwilder,** Corpus Christi, Tex., district office manager, who will be division office manager there; and **L. M. Ford,** Corpus Christi district superintendent of the gas division, who will be division gas coordinator. **Lewis L. Barnes,** unitization engineer in Tulsa, has been named Gulf Coast division joint-operations coordinator. The appointments are effective July 1.

Personals

George C. Hardin, Jr., manager of exploration, land, and production for Michel T. Halbouty, has been promoted to general manager of all Halbouty oil and gas operations. **Thomas D. Barber,** formerly assistant division exploration superintendent for Pan

HARDIN

BARBER

American Petroleum Corp., has joined Halbouty as manager of exploration. Hardin has been with the Halbouty firm since 1946 and has been manager of exploration and production since 1954. Barber had been with Pan Am since 1946.

Daniel L. Sanders, plant operator in Oklahoma's Yellowstone field for Champlin Oil & Refining Co., has been promoted to production engineer and transferred to Enid, Okla.

Adrian W. Silenzi, general manager of Esso Colombiana, S. A., subsidiary of International Petroleum Co., Ltd., has been appointed marketing coordinator for International Petroleum. He will headquarter in Coral Gables, Fla. **Bernardo Mendez,** assistant general manager of Esso Colombiana, moves up to general manager replacing Silenzi. **Frank J. Bennar,** assistant marketing operations manager for International in Peru, will succeed Mendez in Colombia. **Thomas W. King,** marketing manager in Ecuador for International, has retired after 41 years with the company and its affiliates. He will be succeeded by **Charles W. Warning,** cost and operations department head for marketing operations in Peru.

M. Wayne Davis, production foreman with Tennessee Gas & Oil Co. in Hobbs, N. M., has been transferred to Lafayette, La., as operation foreman.

R. E. Farmer, geologist for Shell Oil Co. in Abilene, Tex., has been promoted to southern district geologist in Midland, Tex.

Jere McKenny, Mid-Continent district geologist in Oklahoma City for Kerr-McGee Oil Industries, Inc., has been named manager of the company's West Texas-New Mexico division exploration office in Amarillo, Tex. The division has been expanded to include the Panhandle district and headquarters have been moved to Amarillo from Midland, Tex. **Stan Hardison** will continue as Panhandle district geologist for the company.

G. H. Bowes, vice president and exploration manager for Hudson's Bay Oil & Gas Co., Ltd., has been named exploration advisor. **M. B. Morris,** assistant manager of exploration, will succeed Bowes as manager. Both men came to Hudson's Bay on assignment from Continental Oil Co., the parent company.

Richard G. Darrow, senior engineer in the gas-engineering department of Columbia Gas System Service Corp. in Columbus, Ohio, has been transferred to New York as senior engineer in the engineering and research department. He has been with the company since 1953.

John H. Thacher, Jr., president of Iran California Oil Co., London-based subsidiary of Standard Oil Co. of California, has been named assistant to the chairman of California Standard. **Fredric C. Boucke,** manager of the company's Eastern Hemisphere staff in San Francisco and operations manager for Iran California and California Asiatic Oil Co., will succeed Thacher. This company manages California Standard's 7% interest in the Iranian oil consortium. **George T. Ballou,** a vice president of California Commercial Co. another California Standard subsidiary, will replace Boucke in San Francisco. Ballou has been handling special assignments dealing with the company's Middle East interests.

Frank M. Gibbons, formerly a project manager for oil refinery engineering and construction with Fluor Corp., Ltd., has joined Commonwealth Services, Inc., as supervisor of the company's oil refining and petrochemical consulting activities. He will headquarter in Houston.

James A. Christensen, assistant manager of Standard-Vacuum Oil Co.'s economic-coordination department, has moved up to manager. He succeeds **Willem Holst,** who was recently elected a director. Christensen was with Esso Standard Oil Co. before assignment to Stanvac in 1953.

George W. Clarke, vice president, a director, and central division manager for Pan American Petroleum Corp. in Oklahoma City, is one of several industrial leaders to receive a 1959 Distinguished Achievement medal from Colorado School of Mines. Clarke is a 1923 graduate of the school.

Deaths

Theodore Clinton Towl, Pittsburgh, president of Southern Pipe Line Co. and former president of the old Southern Group of pipelines, died May 19 after a heart attack. He was the son of the late Forrest M. Towl, pioneer engineer who was also a former president of the Southern Group of pipelines.

Alexander Johnston, Sr., 67, retired chairman of Sinclair Crude Oil Co., died May 23 at his home in Tulsa. A graduate of the University of Kansas, Johnston joined Sinclair in 1932.

Clarence A. McKay, 66, retired geologist, died May 22 in a Tulsa hospital after a heart attack. McKay was a major stockholder in the old Adkay and Arthur Oil Companies at one time.

Eric W. Neason, 48, president of Neason Petroleum, Inc., New York cargo brokerage firm, died May 25 in London after a heart attack.

Fon F. Agee, 61, superintendent of materials for Helmerich & Payne, Inc., and White Eagle Oil Co., died May 24 in a Tulsa hospital after a heart attack. Agee had been with Helmerich & Payne for 13 years.

Gibson S. Tucker, 60, shift foreman in the catalytic cracking unit at DX Sunray Oil Co.'s West Tulsa refinery, died May 25 at his home after a heart attack.

F. Jack Danglade, 59, Lovington, N. M., independent operator and New Mexico state senator, died May 25 in a New York hospital of cancer. Danglade, a chemical engineer, was elected to the New Mexico Senate in 1952 as a Democrat. It was his first try at politics.

Francis W. Suggett, 66, pioneer Oklahoma and Texas independent operator and partner in the firm of McElreath & Suggett for many years, died recently at his home in Fort Worth.

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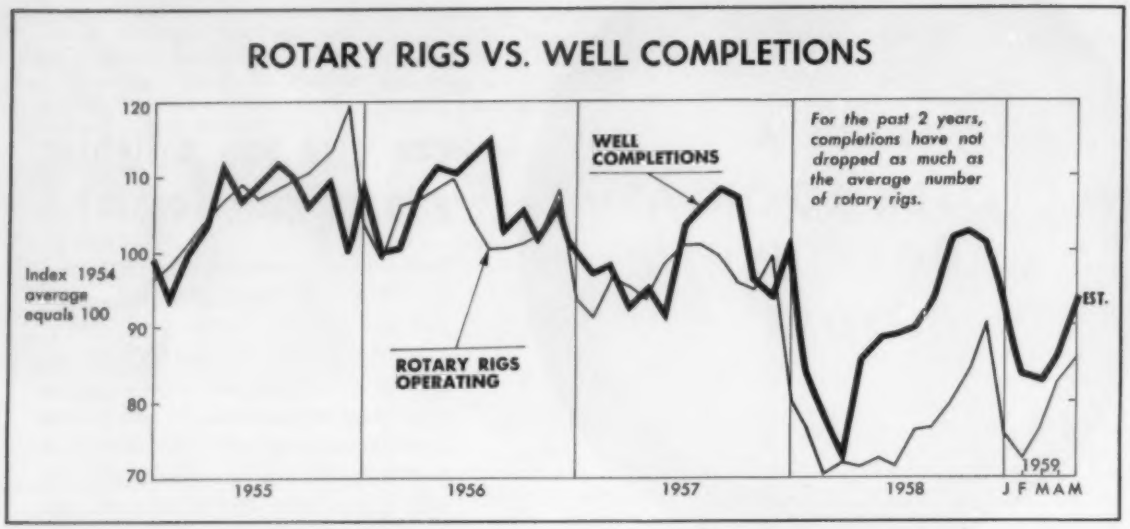


Well and rig totals are gaining

BY JOHN C. CASPER

WELL COMPLETIONS and operating rotary rigs both reached a peak for the year last week. The upturn, which has been under way for about 2 months, makes it possible to get a picture of drilling for the first half. And, with a few limiting conditions, a preliminary pattern for last-half drilling can be drawn.

The rotary-rig count reached 2,197 for May 25. There has been a steady climb since early March, but increased rig activity has been slow in showing up on well-completion reports.

The average number of rotary rigs operating so far this year has been about 5.6% greater than for the same weeks last year. But, total well completions show a gain of only 4%. However, the gains in well completions have been limited to recent weeks.

Total completions shown by the chart on the following page indicate gains over last year for April and May. The chart also shows the possibility for big gains over the next 4 months.

The average of weekly completions last year from June through September was only 934 wells. It is in this 4-month period that operators will pile up increases over 1958.

Completions through May 23 this year totaled 18,937 wells. If operators are to drill the 52,750 wells planned at the first of the year, they will need to complete an average of 1,056 wells per week for the remainder of 1959.

The chart on this page shows a good general relationship between active rotary rigs and reported well completions. But for a given week or month, variations in the series may be difficult to explain fully.

Some of these variations can be accounted for by the normal lag between rig-activity peaks and gains in reported completions.

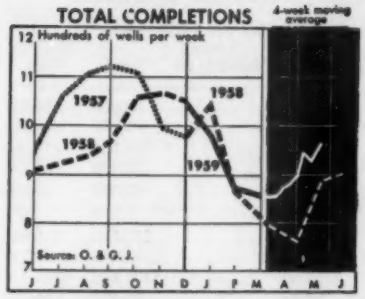
Note that active rotary rigs showed a gain in 1957, starting with June. Increases were reported through August, followed by a downturn that lasted through November. Completions followed the same cycle but with a lag of at least a month at the start.

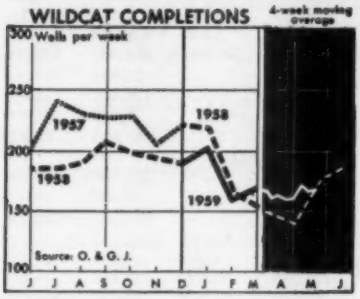
Some of the big gain in well completions for the last half of 1958 did not reflect rotary-rig activity for the period. There were two reasons for the spread between completions and rigs in the last three quarters of 1958.

First, there was a big gain in cable-tool drilling in 1958, and most of it came in the last half of the year. And second, there has been a gradual increase in drilling efficiency with more wells completed per rig (OGJ, Nov. 17, 1958, p. 334).

A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,237,085	UP	36,320	UP	998,000
Crude stocks	259,088,000	UP	3,243,000	DOWN	10,737,000
Completions	1,040	UP	165	UP	68
Refinery runs	7,891,000	UP	207,000	UP	560,000
Gasoline stocks	203,610,000	DOWN	3,006,000	UP	7,857,000
Kerosine stocks	23,212,000	UP	699,000	UP	2,503,000
Distillate stocks	93,802,000	UP	4,163,000	UP	9,338,000
Residual stocks	54,484,000	DOWN	145,000	DOWN	5,869,000
Four-product stocks	375,108,000	UP	1,711,000	UP	13,829,000
Total imports	1,363,100	UP	39,400	UP	49,300





Active Rotary Rigs

	5-25-59	5-18-59	5-26-58
Alabama	7	7	7
Arkansas	17	10	11
Arizona	2	2	0
California	97	96	75
Land	93	92	(†)
Offshore	4	4	(†)
Colorado	49	47	30
Florida	3	3	1
Land	2	2	1
Offshore	1	1	0
Illinois	32	39	54
Indiana	6	9	10
Iowa	3	3	3
Kansas	144	130	128
Kentucky	7	9	7
Louisiana	353	347	281
North	32	31	36
S.-Inland waters	140	150	(‡)
S.-Land	130	114	201
Offshore	51	52	44
Maryland	0	0	0
Michigan	24	23	7
Mississippi	68	63	37
Missouri	1	1	0
Montana	19	20	21
Nebraska	20	20	30
Nevada	0	0	0
New Mexico	123	117	128
New York	1	1	2
North Dakota	41	39	33
Ohio	2	3	0
Oklahoma	259	234	188
Oregon	0	0	1
Pennsylvania	11	10	10
South Dakota	3	2	0
Texas	794	775	640
S.-Inland waters	2	4	(‡)
S.-Land	192	204	129
Offshore	0	0	4
North-east	160	143	(†)
West Central	277	267	(†)
West	163	157	(†)
Utah	27	25	37
Washington	0	0	0
West Virginia	7	7	5
Wyoming	77	74	52
Total U.S.	2,197	2,116	1,798
Western Canada	141	124	160
Eastern Canada	0	0	2
Grand total	2,338	2,240	1,960

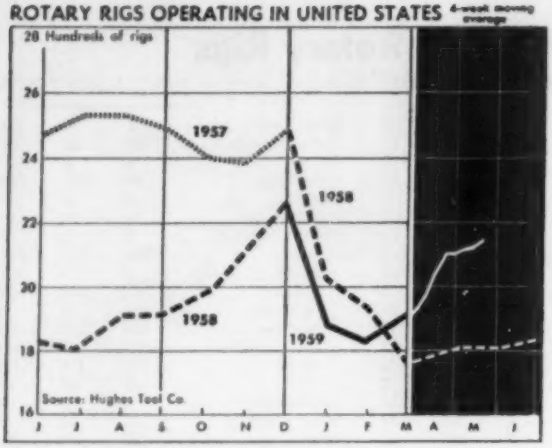
Hughes Tool Co. †Comparisons not available due to change in method of reporting. ‡Included in South-Land.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED MAY 23, 1959

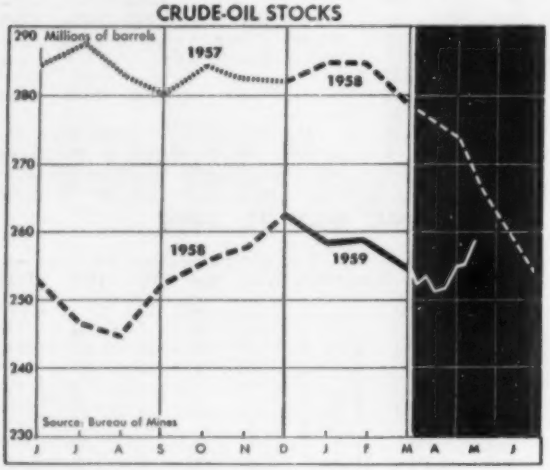
	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1959	1958	Total	Crude	Cond.	Gas	Dry	1959	1958
Alabama	1	0	0	0	1	0	2,305	39	29	1	0	0	0	1	6	10
Arkansas	12	5	0	0	7	0	39,757	329	255	2	0	0	0	2	56	61
California	33	21	0	2	9	1	155,368	596	725	4	0	0	0	4	135	145
Colorado	15	2	0	4	9	0	84,269	275	293	8	1	0	1	6	163	154
Illinois	43	16	0	0	27	0	92,483	808	732	7	1	0	0	6	138	154
Indiana	19	4	0	0	15	0	35,364	270	254	5	0	0	0	5	90	96
Kansas	82	35	0	7	39	1	289,688	1,586	1,397	27	4	0	2	21	355	279
Kentucky	31	13	0	10	8	0	65,270	632	358	1	1	0	0	0	65	43
Louisiana	84	37	7	5	35	0	683,638	1,372	1,291	11	2	1	0	8	174	187
North	28	11	0	4	13	0	115,887	482	435	6	2	0	0	4	76	69
South	50	24	5	0	21	0	509,107	742	675	5	0	1	0	4	92	103
Offshore	6	2	2	1	1	0	58,644	148	181	0	0	0	0	0	6	15
Michigan	24	2	0	9	7	6	63,531	225	150	4	0	0	0	4	54	49
Mississippi	7	2	1	0	4	0	68,124	247	151	5	0	1	0	4	115	78
Montana	1	0	0	0	1	0	3,291	104	140	1	0	0	0	1	40	59
Nebraska	16	3	0	0	13	0	96,908	305	252	7	0	0	0	7	139	118
New Mexico	49	34	2	8	5	0	180,807	709	736	4	1	0	0	3	79	101
West	26	17	1	8	0	0	89,418	316	343	1	0	0	0	1	25	45
East	23	17	1	0	5	0	91,389	393	393	3	1	0	0	2	54	56
New York	0	0	0	0	0	0	0	122	217	0	0	0	0	0	12	14
North Dakota	13	9	0	0	4	0	100,610	184	172	4	1	0	0	3	40	55
Ohio	22	8	0	10	3	1	63,147	375	400	0	0	0	0	0	9	4
Oklahoma	128	76	1	9	42	0	411,944	2,324	2,570	15	1	0	1	13	349	351
Pennsylvania	49	12	0	29	3	5	165,482	212	184	0	0	0	0	0	3	6
Texas	364	185	15	24	124	16	1,625,735	7,469	7,119	69	8	2	0	59	1,400	1,473
Dist. 1	14	3	0	0	11	0	23,602	446	388	6	0	0	0	6	117	149
Dist. 2	16	2	1	6	7	0	83,148	325	289	2	0	0	0	2	89	76
Dist. 3	26	13	6	1	6	0	197,195	443	510	2	1	1	0	0	101	107
Dist. 4	34	12	3	3	12	4	161,589	486	473	5	0	0	0	5	131	144
East	14	6	2	1	5	0	77,869	422	493	3	0	0	0	3	89	138
Dist. 7-B	46	17	0	0	28	1	139,561	1,049	925	19	2	0	0	17	281	263
West	114	81	1	1	28	3	589,449	2,334	2,118	13	0	0	0	13	282	296
Dist. 9	74	41	0	3	22	8	229,859	1,413	1,426	15	5	0	0	10	262	257
Dist. 10	26	10	2	9	5	0	123,463	551	497	4	0	1	0	3	48	43
Utah	4	3	0	0	1	0	23,308	138	181	1	0	0	0	1	38	32
West Virginia	23	4	0	15	4	0	57,281	278	269	3	0	0	2	1	9	9
Wyoming	15	6	0	1	8	0	62,063	310	292	5	0	0	0	5	99	85
Misc. (Tenn.)	5	1	0	0	4	0	5,030	28	40	3	1	0	0	2	21	34
Total U. S.	1,040	478	26	133	373	30	4,375,400	18,937	18,207	187	21	4	6	156	3,589	3,597
Previous week	875	450	12	55	335	23	3,686,228	.....	.....	157	15	0	2	140	.....	.....
Cum. 1959	18,937	9,541	481	1,392	7,020	503	79,596,233	.....	.....	3,589	363	50	113	3,063	.....	.....
Cum. 1958	18,207	9,050	452	1,375	6,908	422	77,389,177	.....	.....	3,597	342	60	116	3,079	.....	.....
Western Canada	47	27	0	8	12	0	226,747	910	889	10	2	0	1	7	331	326
Ontario	0	0	0	0	0	0	0	86	.....	...	...	...	...	...	.....	.....

PRODUCTION

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	5-16-59	5-9-59	5-17-58
Pennsylvanian	2,438	2,481	2,948
Other Appalachian	1,552	1,529	1,472
Illinois, Indiana, Michigan	8,973	8,871	11,197
Nebraska and North Dakota	2,483	2,403	2,116
Kansas	10,014	9,839	10,694
Oklahoma	16,612	15,947	17,331
Arkansas	1,794	1,907	2,484
Louisiana	19,408	18,953	17,694
North	3,279	3,358	2,902
South	16,129	15,595	14,792
Mississippi, Alabama, Florida	2,245	2,365	2,369
New Mexico	7,968	7,844	7,612
Texas	113,061	111,680	117,120
East Texas	9,037	9,099	7,623
West Texas	54,257	53,843	54,621
Texas Gulf	18,076	17,819	24,093
Other Texas	31,691	30,919	30,783
Wyoming	15,384	14,911	15,669
Other Rocky Mountain	9,292	9,040	7,519
California	32,524	33,284	38,959
Foreign	†15,339	14,791	17,771
Total	**259,088**	255,845	272,955

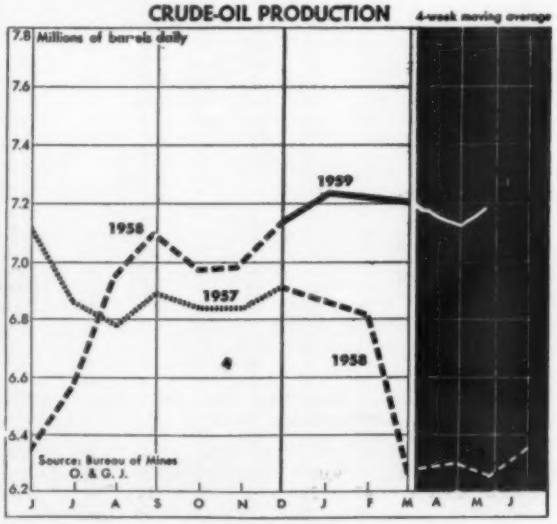
*Bureau of Mines. †Includes 4,755,000 bbl. in California.

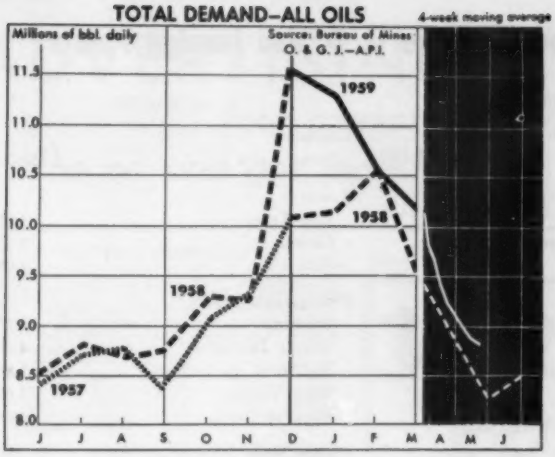
DAILY AVERAGE PRODUCTION FOR WEEK

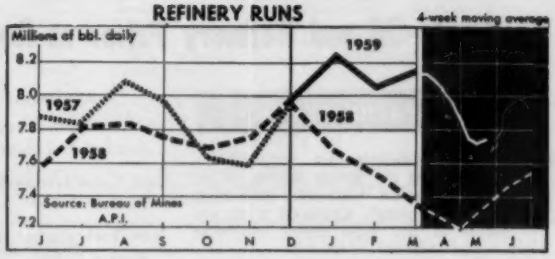
	May 23, 1959			May 16
	Crude oil	Lease condensate	Total	total
Alabama	16,025	.....	16,025	16,575
Arkansas	80,425	200	80,625	81,450
California	839,500	.....	839,500	839,100
Colorado	128,400	.....	128,400	127,800
Eastern	42,300	.....	42,300	44,500
Florida	1,150	.....	1,150	1,150
Illinois	212,500	.....	212,500	216,800
Indiana	31,400	.....	31,400	31,200
Kansas	†335,800	.....	†335,800	†317,080
Kentucky	66,400	.....	66,400	66,200
Louisiana	866,750	106,000	972,750	973,225
North	111,750	5,000	116,750	117,225
South	755,000	101,000	856,000	856,000
Michigan	26,300	.....	26,300	25,700
Mississippi	121,600	4,825	126,425	126,425
Montana	79,300	.....	79,300	78,900
Nebraska	61,000	.....	61,000	61,400
Nevada	100	.....	100	100
New Mexico	292,500	5,200	297,700	297,700
North Dakota	40,400	.....	40,400	38,000
Oklahoma	†573,500	.....	573,500	†548,100
Texas	2,791,000	70,275	2,861,275	2,861,275
Dist. 1	44,000	3,000	47,000	47,000
Dist. 2	122,000	7,500	129,500	129,500
Dist. 3	360,000	34,000	394,000	394,000
Dist. 4	194,000	8,600	202,600	202,600
Dist. 5	32,000	300	32,300	32,300
Dist. 6	119,000	6,500	125,500	125,500
East Texas field	160,000	.....	160,000	160,000
Dist. 7-B	140,000	100	140,100	140,100
Dist. 7-C	136,000	3,625	139,625	139,625
Dist. 8	1,160,000	4,000	1,164,000	1,164,000
Dist. 9	207,000	1,800	208,800	208,800
Dist. 10	107,000	850	107,850	107,850
Utah	117,100	.....	117,100	106,000
Wyoming	337,000	.....	337,000	341,900
Others	‡135	.....	‡135	‡185
Total U. S.	7,060,585	186,500	**7,247,085**	7,200,765
Change from prev. week, up			**46,320**	
Canada	†467,500	.....	†467,500	†444,900
Total U.S. Prod.—Jan.1-May 23				1,028,511,430 bbl.
Same period last year (crude plus cond.)				*929,961,050 bbl.

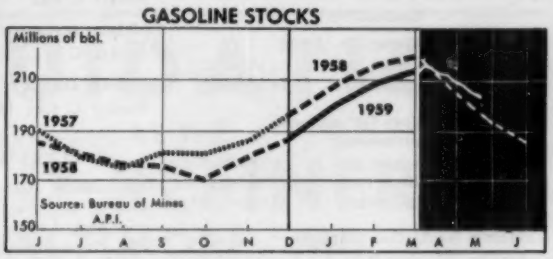
*Includes 23,448,325 bbl. condensate. †Week ended previous Monday. ‡Arizona, South Dakota, and Washington.

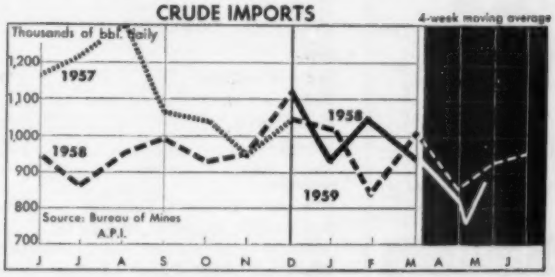
CRUDE-OIL PRODUCTION

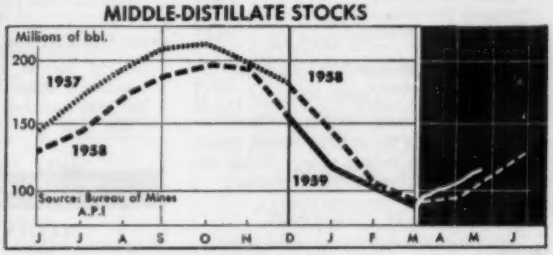


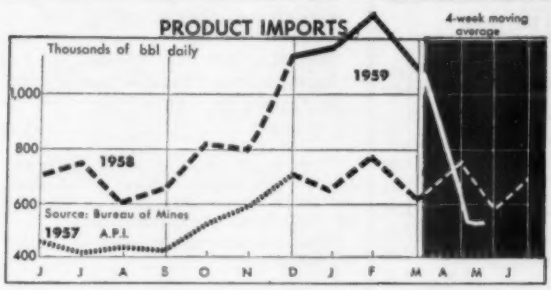


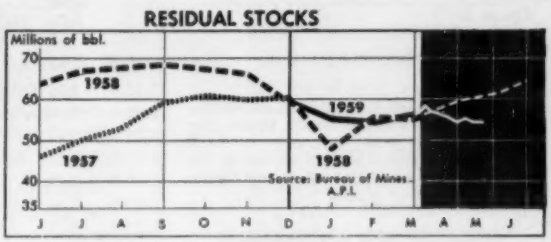












API REFINERY REPORT—MAY 22, 1959

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, May 1958 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	990	429.3	12.0	287.9	150.0	48,465	9,241	33,079	12,820	1,112	495.8	21.6	305.5	184.3
Appalachian:														
Dist. 1	81	46.0	2.9	16.1	11.9	5,317	529	1,880	250	82	31.7	2.1	16.5	6.6
Dist. 2	77	51.9	5.3	14.3	10.3	2,612	470	894	224	85	52.3	3.2	15.3	7.4
Ind., Ill., Ky.	1,446	726.8	52.6	271.9	161.0	35,911	4,197	13,752	3,721	1,371	698.9	60.4	277.5	140.4
Minn., Wis., Dak.	95	49.8	2.6	30.6	11.0	6,664	662	3,398	382	102	47.8	7.0	25.5	10.9
Okla., Kans., Mo.	700	406.0	5.4	167.6	17.4	19,312	1,008	6,728	778	726	396.4	12.4	167.8	20.0
Inland Texas	287	177.3	8.1	42.4	21.4	7,276	289	1,346	2,051	265	168.7	6.8	34.1	19.8
Texas Gulf Coast	2,003	974.7	69.1	495.4	191.3	25,622	3,283	11,685	4,925	1,642	839.3	72.1	414.1	174.5
La. Gulf Coast	690	329.0	43.3	126.4	51.9	12,207	2,233	4,893	1,374	599	323.7	29.9	142.5	37.4
N. La. and Ark.	101	44.3	5.0	18.7	6.4	4,369	603	2,022	135	101	42.2	5.5	23.7	5.9
Rocky Mountain:														
New Mexico	19	10.6	0.3	4.0	2.3	785	47	118	122	29	15.0	0.3	5.7	2.6
Other Rocky Mt.	264	126.4	1.7	59.1	42.4	6,110	200	2,096	1,046	239	110.1	1.8	51.2	27.3
West Coast	1,138	530.6	4.3	196.2	267.6	28,960	450	11,911	26,656	1,078	446.7	3.9	156.8	283.4
May 22, 1959	7,891	3,902.7	212.6	1,730.6	944.9	203,610	23,212	93,802	54,484	7,411	3,668.6	227.0	1,636.2	920.5
May 15, 1959	7,684	3,831.6	260.6	1,762.1	891.4	206,616	22,513	89,639	54,629	.....	.....	.....	.....	.....
May 23, 1958	7,331	3,668.4	244.9	1,693.3	943.9	195,753	20,709	84,464	60,353	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
Regular (89 octane)	11.375-11.75
Premium (99 octane)	14.375-14.75
Gulf Coast (cargoes for coastwise or export movements):	
★ Regular (90 octane)	10.00-10.50
★ Regular (92 octane)	10.25-10.75
★ Premium (98 octane)	11.50-12.00
California (rack) (Los Angeles):	
Regular (88 octane)	12.65
Premium (94 octane)	13.65
Premium (98 octane)	14.65
Caribbean area (cargoes):	
★ Regular (87 octane)	9.875
★ Premium (97 octane)	11.625

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:	
Grade 26-70	4.5
Breckenridge:	
Grade 26-70	4.0

*If 26-70 natural is considered as 100%, prices for lower-vapor-pressure grades increase 2.5% for each unit drop in Reid vapor pressure down to and including 16 lb. Prices for grades below 16 lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
Kerosine 42-44	10.00
Diesel oil (58 d.i. and above)	9.75
Distillate No. 1	9.75
Distillate No. 2	9.00
Gulf Coast (cargoes):	
Kerosine 41-43	9.00-9.125
Distillate No. 2	8.50-8.625
New York Harbor (barges):	
Kerosine 41-43	10.50
Distillate No. 2	10.00
Diesel fuel, 48-52 d.i.	10.25
Caribbean area (cargoes):	
Distillate No. 2	8.625

WAX (LB.)

Oklahoma (Group 3):	
132-135 A.m.p. (semi-refined) in tank car	6.50
New York (export):	
126-130 A.m.p. crude-scale (solid in bags or barrels)	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$1.85-2.00
Gulf Coast (cargoes):	
Bunker C fuel	$2.00
New York Harbor (barges):	
Bunker C fuel	$2.37
Caribbean (cargoes):	
Bunker C	$2.00
California (rack):	
Bunker C fuel, Los Angeles	$2.15

LUBRICATING OILS

Mid-Continent (Group 3):	
150-160 bright stock, solvent refined, 0-10 pp., 95 v.i.	23.0
200 vis. neutral oil, solvent refined, 0-10 pp., 95 v.i.	20.5
Pennsylvania Grade:	
145-155 vis. at 210, bright stock, 8 color, 25 p.t.	22
200 vis. neutral (180° at 100°), 25 p.t.	21

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Oklahoma	Gulf Coast Tex.*	West Tex.† N.M.	Wyo. (sour)
14-14.9	$1.86	....	....	....	....
15-15.9	1.95	....	....	....	$1.81
16-16.9	2.04	....	....	....	1.86
17-17.9	2.13	....	....	....	1.91
18-18.9	2.23	....	....	....	1.96
19-19.9	2.32	....	....	....	2.01
20-20.9	2.41	$2.49	....	$2.35	2.06
21-21.9	2.50	2.52	....	2.38	2.11
22-22.9	2.60	2.55	....	2.41	2.16
23-23.9	2.69	2.58	$3.44	2.44	2.21
24-24.9	2.78	2.61	3.46	2.47	2.26
25-25.9	2.84	2.64	3.48	2.50	2.31
26-26.9	2.90	2.67	3.50	2.53	2.36
27-27.9	2.95	2.70	3.52	2.56	2.49
28-28.9	3.01	2.73	3.54	2.59	2.54
29-29.9	3.07	2.76	3.56	2.62	2.59
30-30.9	3.12	2.79	....	2.65	2.63
31-31.9	3.20	2.82	....	2.68	2.67
32-32.9	3.27	2.85	....	2.71	2.71
33-33.9	3.34	2.88	....	2.74	2.75
34-34.9	3.41	2.91	....	2.77	2.79
35-35.9	3.47	2.94	....	2.80	2.83
36-36.9	3.52	2.97	....	2.83	2.87
37-37.9	3.56	2.99	....	2.86	2.89
38-38.9	....	3.01	....	2.89	2.91
39-39.9	....	3.03	....	2.92	2.93
40-40.9	....	3.05	....	2.95	2.95

*Low cold test crude. †Sour.

Effective dates of broad changes: California, 1-26-59; East of California, January 3-10, 1957; Pennsylvania Grade 4-1-59.

FLAT PRICES

Louisiana:	
Sweet Lake	$3.00
Texas:	
East Texas	3.25
Conroe	3.53
Van	3.08
Pennsylvania Grade:	
Bradford	4.25
Middle District	4.07
Southwest Pennsylvania	3.80
West Virginia	3.67
Buckeye Grade	3.25
Illinois Basin	3.00

FOREIGN

Canada:	
Leduc-Woodbend	2.53
Redwater (Alta.)	2.42
Smiley (Sask.)	2.18
Pembina	2.38
Venezuela:	
Cumarebo, 48°-49.9°, Tucupido	3.34
San Joaquin, 41°-41-9°, Puerto La Cruz	3.08-3-10
Oficina, 35°-35.9°, Puerto La Cruz	2.80
Tia Juana medium, 26°-26.9°, Amuay*	2.30
Quiriquire, 16.0°-16.4°, Caripito	2.10
Lagunillas heavy, flat, Las Piedras*	2.10
Bachaquero, flat, 15°-16°, Las Piedras*	1.88

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° very 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Middle East, Persian Gulf (cargoes f.o.b. lifting port):	
Arabian, about 34°, Ras Tanura	$1.89
Iranian, 34.0°-34.9°, Bandar Masur	1.86
Iranian, 34.0°-34.9°, Abadan	1.81
Iraq, 36.0°-36.9°, Fao	1.82
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.67
Qatar, about 41°, Um Said	2.05
Middle East, E. Mediterranean:	
Arabian, about 35°, Sidon	2.29
Iraq, about 35°, Tripoli, Banias	2.29
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°	2.57

TANKER RATES PER LONG TON

(Latest reported spot fixtures)

★ Gulf-U.S.N.H., dirty (USMC —27.5%)	$2.07
★ Carib.-U.S.N.H., clean (ATRS —45.0%)	1.51
★ Carib.-U.S.N.H., dirty (USMC —60%)	1.08
★ P.G.-Japan, dirty (USMC—77.5%)	2.30

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WELL DRILLS - CORE DRILLS. Everything for well and core drilling in both new and used equipment at money saving prices. Fishing tools rented. Send for bulletins. Pressey & Son, Pueblo, Colo.

FOR SALE—6,500' Grade E 4½ Flash-Weld Drill Pipe 6¼ Hughes Joints, Tubscope #1. 8,500' extra hole Grade E 4¼" Flash-Weld, Hughes Joints, Tubscope #1, located Liberal, Kansas. Call CEntral 2-6318, Oklahoma City.

18,000' 3" STANDARD Number One Use Continuous Weld Line Pipe Range 1, 2, and 3, Threaded and Collared. Call or write, George Barber at Hamilton 8-1301 or Box 9247 Dallas, Texas.

FOR SALE OR TRADE for 1500 Failing or oil production. 1 Cooper M. double drum, 8 x 10 single 65' mast, on 51 Int. tandem; 1 Cooper P-32-26 double drum 8 x 7 twin 65' mast, on 53 Int. tandem; 1 Cooper E. single drum, 8 x 10 single 65' mast, on 53 Int. tandem; 1 Cooper W. double drum, 8 x 7 single mast, on K-8 Int.; 1 Cooper W. single drum, 8 x 7 single mast, on 52 Int. All equipped for propane. Numerous misc. items, cars, trucks, pickups, equity radio equipment, 1957 Tri-Pacer, 3 sets Hillman-Kelly hydraulic tongs, 3 advance air tubing spiders; Living quarters, office, shop & land at Webb City, Okla. Geo. Barnard, 5311 East Archer, Tulsa, Oklahoma.

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"As Is, Where Is"

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- BOILER PLANT: 6—B&W BOILERS, 70,000#/hr. 600 psi. (1952)

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4—Portable Furnaces 10, 15, 11.5 and 12.7 mil. BTU/hr.
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FOR SALE—3 miles 2" line pipe, 127' Mast 7' Substructure, 131' Mast 11' Substructure, one 3 motor unit drawworks, one two motor unit drawworks, Waukesha engines. Call CEntral 2-6318, Oklahoma City.

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WANTED—Man to supervise dismantling tank farm, piping, and refinery. Gulf Coast area. Contact Brill Equipment Co. 4101 San Jacinto St., Houston, Texas. JA 6-1351.

OIL INDUSTRY EMPLOYMENT SERVICE. Tom Robinson, owner, 405 Tuloma Bldg., Tulsa, Okla. GI 7-5974. We work with graduate, experienced engineers.

FOREIGN - DOMESTIC EMPLOYMENT. Oil, Chemical, Industrial. Write for details without obligation. Accredited Personnel Services, P. O. Box 6006, New Orleans 14, La.

EXPERIENCED GEOLOGIST with minimum five years experience; Louisiana—Texas areas. Age under 32. Location Dallas, Texas. Send detailed resume, transcript of grades, snap-shot and salary desired to Box L-353, The Oil and Gas Journal Tulsa, Oklahoma.

Production Engineers

Well known expanding major oil company has openings in district offices of domestic oil and gas producing operation. Minimum of three years production experience required; water flood experience desirable. Response should include salary expected and complete resume of education and experience. Our employees have been informed of this advertisement.

Box L-309,
The Oil and Gas Journal,
Tulsa, Oklahoma.

—ENGINEER WANTED—

Experienced engineer capable of establishing and supervising engineering department for construction of petroleum products storage terminals, including complete design, issuance of quotation requests and material authorizations, supervision of construction engineers and approval of subcontractors' designs. Must be able to provide preliminary design rapidly and estimate construction costs accurately enough to provide basis for competitive bids. Must have field experience in design and construction of terminals and pipeline including pipeline electrical, civil and mechanical design, and have mental capability of working for non engineer. Will be located in Southwest. Some travel required. Will guarantee three years employment at $20,000.00 per year if work is satisfactory. Send resume including references to:

BOX L-352,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

HELP WANTED

WANTED: Petroleum engineers and drilling personnel for appointments overseas. If interested, contact Mr. Looper, Overseas Craftsman's Association, 426 South Spring Street, Los Angeles.

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BAKER OIL TOOLS, INC.

Desire Mechanical or Petroleum Engineers with oil field background, preferably with design experience.

Engineers presently employed by Oil Companies will be considered and employed only with the understanding and approval of their company.

Please apply to Personnel Department in **Los Angeles,** P. O. Box 2274, Terminal Annex, Los Angeles 54, California, or in **Houston,** P. O. Box 3048, Houston 1, Texas.

Physical Metallurgist
OR
Metallurgical Engineer

B.S. with minimum five years manufacturing experience.

Well versed in heat treat techniques and procedures for ferrous and non-ferrous metals. Capable of specifying metals and treatment to specific use. Should be familiar with welding, machining and finishing.

Capable of handling metallurgical aspects of oil well equipment manufacturing plant. Location Southwest.

Salary open. All replies confidential. Send complete resume to:

Box L-332,
The Oil and Gas Journal,
Tulsa, Oklahoma.

HELP WANTED

PETROLEUM ENGINEER with secondary recovery experience. Send resume of education and experience. Answer, Box L-358, The Oil and Gas Journal, Tulsa, Oklahoma.

NEW OIL EMPLOYMENT Directory, foreign and domestic, showing where to apply for jobs. 500 selected producing, refining, LPG and pipeline companies. Nationwide. $7.50 cash. OIML Co., Box 2603, Tulsa, Okla.

DISTRICT MANAGER-GEOLOGIST. Denver Office covering Rocky Mountain region. Minimum of five years experience in this area. Must be aggressive with initiative and ability to perform duties of planning and supervision of exploration program at district level. Medium size, progressive oil company. Growth potential. Submit resume, including references, recent photograph, and salary required to Box L-331, The Oil and Gas Journal, Tulsa, Oklahoma. Replies are strictly confidential, and our employees know of this advertisement.

PRODUCTION ENGINEER: Growing independent oil company has opening for graduate petroleum engineer to supervise drilling and production operations in Wyoming. Minimum 4 to 6 years experience in field production work. Age: 28 to 40. Salary commensurate with experience. Inquiries will be confidential. Submit resume of experience and education to: Box L-351, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEERS (2) under 32 for North Louisiana and Dallas, Texas, locations. Minimum five years experience in secondary recovery, reservoir, and/or unitization, and general production engineering. Send detailed resume, transcript of college work, and small photo to Box L-354, The Oil and Gas Journal, Tulsa, Oklahoma.

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As a result of continued growth on an international scale, PIPE LINE TECHNOLOGISTS, INC. and affiliated companies will continue to have job opportunities for experienced Pipe Line Engineers.

We have opening at both intermediate and advanced levels in both the United States and foreign locations. Normally, the initial assignment of new staff members is in our Houston headquarters with the possibility of recurring short or long term assignments in other parts of the United States and foreign countries.

Resumes, which will be kept strictly confidential, are invited from graduate engineers with experience in responsible capacities in hydraulic and mechanical design of pipe lines and pipe line facilities, including pump stations, compressor stations and terminals. Experience in estimating and economic studies also desirable. Openings also are expected for experienced construction engineers capable of being assigned as Project Engineers on foreign jobs.

These are unusual opportunities for well-qualified men who want to work in an atmosphere where the individual can have an important impact on the overall picture by the competent handling of challenging and out-of-the-ordinary job assignments.

Salaries commensurate with training and work experience. Liberal, well-balanced employee benefit plans.

Please include in resume full particulars regarding education, experience and salary requirements. Arrangements will be made for individual interview with interested and qualified persons.

Pipe Line Technologists, Inc.
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Houston 27, Texas

SITUATION WANTED

PETROLEUM ENGINEER— With 16 years of varied experience in secondary recovery, property evaluation, reservoir analysis, drilling, workovers, completions, and production operations desires position with aggressive independent. Box L363, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST—8½ years Gulf Coast, 1 year Rocky Mtn.; M.S., trained in administration, developing exploration programs, developed and submitting prospects; desires position with company entering exploration, or expanding; prefer Houston, consider any area. Box L-360, The Oil and Gas Journal, Tulsa, Oklahoma.

FORMER CHIEF Petroleum Engineer major oil company with foreign and domestic experience retiring in September, wants part-time or consulting work. Prefer Houston area but will relocate. Box L-356, The Oil and Gas Journal, Tulsa, Oklahoma.

WHAT SMALL independent needs a young agressive geologist with four years subsurface experience, who understands production practices? Resume upon request. Box L-365, The Oil and Gas Journal Tulsa, Oklahoma.

GEOLOGIST, 37, exceptionally well qualified to direct an exploration and development program for large independent or investment group. 13 years of comprehensive experience in Texas, New Mexico and Mid-Continent Areas. Box L-359, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST, B. S., 26, married, one child. Desires position as geologist in Ohio, Michigan or Tri-state area. No experience in geology; two years in metallurgy with well-known industrial research organization. Box L-355, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER-PRODUCTION Supt., 32, married, B.S. degree-Texas A.&M., nine years of diversified experience on Gulf coast and Lake Maracaibo Venezuela. Experienced in Geology, drilling, workovers, production facilities, field gas compression, dehydration and water clarification, gas measurement & sales, Railroad Commission rules and regulations. Bilingual in Spanish & English. Desire position with aggressive independent preferably on the Texas Gulf Coast. L-361, The Oil and Gas Journal, Tulsa, Oklahoma.

Petroleum Engineer—Production
Want to locate in or near the mountains. 16 years Production Engineering with Major. 8 years Independent as Geological well sitter, well completion and workover supervisor and manager of producing leases. Interesting work in desiraable location first consideration. Best references. **Box L-369, The Oil and Gas Journal, Tulsa. Oklahoma.**

Purchasing Agent

Eighteen years diversified experience as Purchasing Agent in the procurement of drilling, production, refining, and marketing materials, supplies, and equipment. Also possesses oil well supply company and accounting experience. Good health and habits. Brochure on request. Prefer Wichita Falls, Texas area. Consider relocating. Best references. Available now.

BOX L-326,
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TULSA, OKLAHOMA.

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Former drilling contractor with 25 years experience in drilling, production, exploration and acquiring oil and gas production for his own account, desires connection with either individual, group, or company that needs management, supervision and future exploration direction. Last 15 years in West Texas and New Mexico. Location unimportant if justifiable.

Either domestic, foreign or both.

Would desire opportunity to participate in future exploration and development. Have qualified geological and exploration staff.

R. MAKIN
P. O. Box 1628 Hobbs, New Mexico

SITUATION WANTED

WATER FLOOD Engineer—Manager. Eleven years, Major-Independent companies diversified experience in Mid-Continent, Gulf Coast areas. Extensive water flood development and operation. Primary drilling, workovers, completions, production, automation, unitization, evaluation, reservoir, purchasing, administration. Desire responsible position with aggressive company. Box L-364, The Oil and Gas Journal, Tulsa, Oklahoma.

MR. EMPLOYER—Many job applicants are presently employed and prefer to use an employment agent when changing jobs. We currently have some really outstanding candidates seeking both foreign and domestic opportunities through the use of our confidential services which include P. E.'s, M.E.'s E.E.'s, Geophysicist, Geologists, Production Foreman, and others. Please send your job description and application blank form and we shall prompt our most likely candidate to apply for your job. Accredited Personnel Services, Inc. P. O. Box 6006 New Orleans 14, La.

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BUSINESS OPPORTUNITIES

SOME WORKING interest for sale, price only $375 per ⅛ to drill shallow well on 80 acre lease in proven area with NO. 1-A staked two locations from pumper and on same pool. Write L. Snavely, Geologist, Box 315, Coweta, Oklahoma.

FOR SALE: Well Service business. Steady work. Major Company. 2 or 3 rigs. 3,000' Okla. area. Box L-346, The Oil and Gas Journal, Tulsa, Okla.

ESTABLISHED WELL SERVICE company in West Texas for sale. Excellent reputation. New equipment. Experienced employees. Box 1417, Levelland, Texas.

WANTED CONTRACTOR to bid on removal of 6,000 tons pipe valves and fittings. Gulf Coast area. Contact Brill Equipment Co., 4101 San Jacinto, Houston, Texas.

FINANCIAL CONTACTS, Underwriters, Private Brokers reached. No shopping. Confidential. Send details to Consultant—817—51st Street, Brooklyn, N. Y.

Valuable Distributorships Now Available

Several choice territories available in oil industry supply centers in the U.S.A. and foreign oil producing countries for exclusive franchise on important oil tool development.

This product is made to fit any oil well tubing string or lease oil line for the purpose of reducing or eliminating paraffin, emulsion, scale and pitting type corrosion. It is a permanent tool requiring no replacement or servicing. Several hundred are now in use in the U. S. Some early test units are still working fine after five years continuous service.

These franchises available only to those who have an aggressive sales engineering organization and well financed. Approximately $15,000 will handle large area. Potential earnings per territory should be in excess of $50,000 per year. For appointment, write or call:

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DALLAS 1, TEXAS

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I WILL BUY your producing interest or drill your shallow prospect. U. S. Andersen, 8350 Santa Monica Blvd., Los Angeles 46, Calif.

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DRILLING BLOCKS; Geologist has excellent Geological prospects, average 6,000 feet depth; several wash down and deepening jobs; mostly open acreage; will take override. Box L-335, The Oil and Gas Journal, Tulsa, Oklahoma.

WORKING INTERESTS up to ½ for sale, Chautauqua Co., Kansas. 150 acres offset to free flood and new well 1,100 ft. sand. Box L-328, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: Offset shallow drilling deals in the Illinois, Indiana, and Kentucky basin. Can drill one well per month. Send all replies to Box L-311, The Oil and Gas Journal, Tulsa, Oklahoma.

OIL AND GAS LEASE
YOAKUM CO., TEXAS

160 acres, 5 year contract. Strategically situated for exploration of Permian and deep structures. Sale price of this lease is $200 per acre, with $2 delay rental. Location; S½ S½ section 596. Write:

Dr. J. A. Robinson,
233 Twenty-first Pl., Santa Monica, Calif.

Caddo-Pine Island Field

160 acre federal oil and gas lease, full five year term, in T. 21 N., R. 16 W., La. Mer. S½SE¼, Sec. 2; and E½SE¼, Sec. 11. High bidder at federal auction will assign outright or with small override.

Box 7587 Phone
Washington 4, D. C. NAtional 8-7377

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TO CLOSE ESTATE Working interest up to 39.258%, with operating rights in two producing wells, Custer County, South Dakota. 160 acre lease. 1,295 ft. sand. Initial production discovery well 200 bbls. Write M. H. Phifer, Dewey, So. Dakota.

PRODUCTION WANTED

OIL PRODUCTION WANTED: Adequate engineering information should be available for inspection. Box 31 R 401, The Oil and Gas Journal, 4041 Marlton Ave., Los Angeles 8, Calif.

WANTED: Oil properties. 100 to 5,000 barrels daily in Oklahoma and Kansas. Morris Sitrin, P. O. Box 1160, Tulsa, Okla.

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APPALACHIAN BASIN—Weekly scout reports; exploration and development—New York, Pennsylvania, West Virginia and Maryland. For information write: H. & R. SCOUTING SERVICE, Box 312, Coudersport, Penna.

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LEGAL

SEALED BIDS will be received until 2:00 P. M. CST June 9, 1959, and opened at that time in the office of the Fort Berthold Indian Agency, New Town, North Dakota, for the leasing of 28,426 acres of allotted Indian land and 1,148 acres of Tribal land located in McKenzie, Dunn and Mountrail Counties, North Dakota, for oil and gas mining purposes. The details of the lease offering and how and where to file bids may be obtained by addressing the inquiry to the Superintendent of the Fort Berthold Indian Agency at New Town, North Dakota or call MAin 7-4340.

LEGAL

SEALED BIDS will be received until 10:00 A. M., Mountain Standard Time, June 9, 1959, and opened at that time at the Fort Peck Indian Agency, Poplar, Montana, for the leasing of 29 tracts of Tribal land comprising 5,398.54 acres and 111 tracts of individually owned trust or restricted Indian Lands comprising 19,956.94 acres located in Sheridan & Daniels Counties, Montana and Williams County, North Dakota, for oil and gas mining purposes. The details of the lease offering and how and where to file bids may be obtained by addressing the inquiry to the Superintendent, Fort Peck Indian Agency, Poplar, Montana, or telephone, Poplar PO 8-3441.

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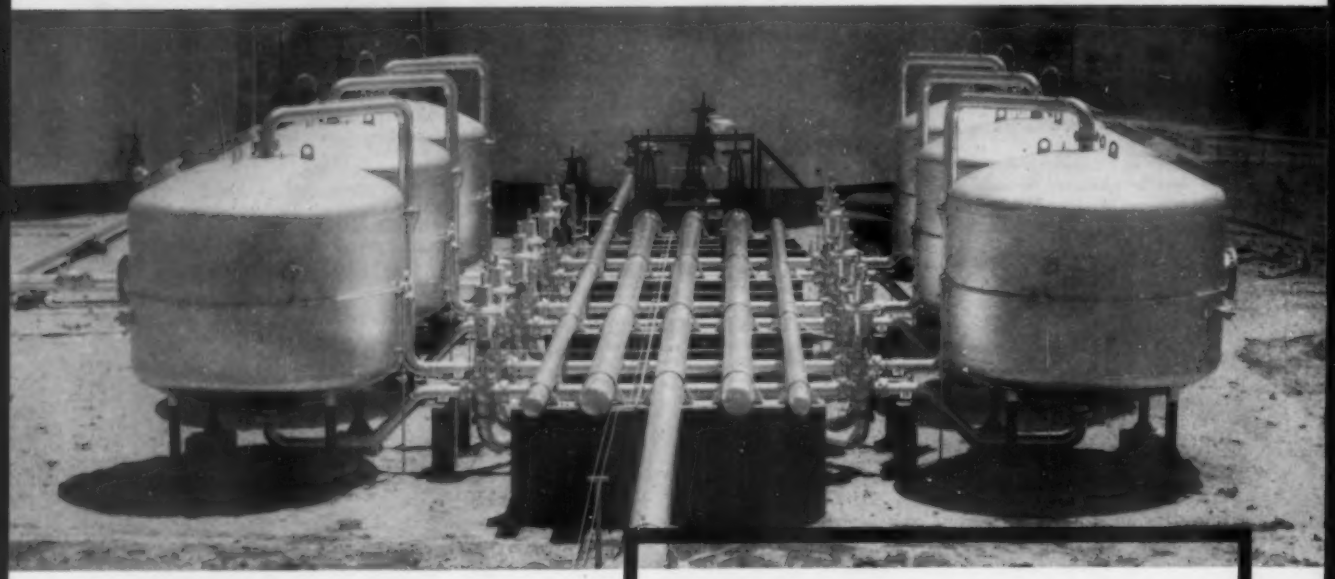
for backwashing from 1 to 10 filters in sequence



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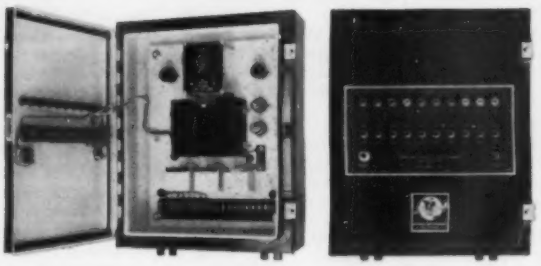
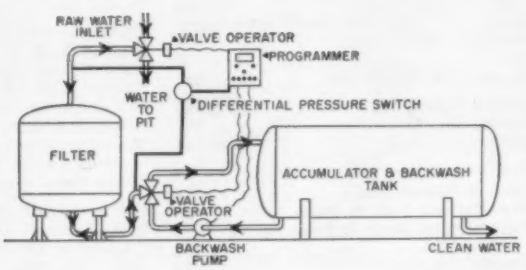
The Backwash Filter Programmer is a rugged industrial-type electrical control system designed for long life and trouble-free operation. The housing is weather-proof, dust-tight (NEMA Type 12) for wall mounting. All terminals, sockets and other electrical components are clearly marked to assist in installation and service of the system. The panel requires only 110 VAC, 60 cycle for operation.





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